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Pacific Cables. SLOWLY, but surely, the scheme for a British cable across the Pacific is taking shape. A conference of influential colonists—Canadian and Australian—was held in London last month, when a route from Vancouver by way of Hawaii, Fanning Island, Samoa, Fiji and New Zealand to Australia was considered and approved. The Imperial Government will now be called upon to aid the project, and in view of the growth of the Antipodean dependencies, as well as for other political reasons, will probably lend its support. The rate between England and Australia will, it is said, be $1 per word. The time is ripe for the execution of the plans, to which we have now and again directed attention, and we look for a speedy laying of the cable.

Western Union Expansion. THE Western Union Company has once again added to its system and its cares by taking over the Atchison, Topeka and Santa Fe telegraph lines, altogether, it is said, about 3,500 miles. This is, perhaps, not so big a gobble as it looks, as the railroad company will perform its own business, simply turning over to the Western Union a commercial service that has not been of particular benefit to any body. Although this aggrandisement of the Western Union is not a thing to rejoice in, it is probably satisfactory to the Texans and others that rates will be reduced about 25 per cent. These are the days when the Western Union Company grows, not from any great desire of the management, but because it can't help it.

Underground Work. THE liberal spirit which has from the beginning characterized the work of the Brooklyn Subway Commission has made it possible for each electrical company to select its own method of burying its wires. In this way they have already done a large amount of work, which will go toward giving them some indications of what to avoid and what to adopt; and they are still engaged on the problem of selecting a system suitable for each service. As noted in our columns this week the New York & New Jersey Telephone Company is putting down wires on the Brooks system, which is also in use in this city and in Philadelphia over a limited area, and its more extended use in the present instance will serve as a good test of its efficiency for telephone work.

Good Work Tells. WE have so often pointed out the necessity for good and reliable work in electric construction of all kinds that an exemplification of the truth thereof, if such were indeed wanted, is deserving of note. We refer particularly to the account given in another column of the total prostration of all electric wires at St. Joseph, Mo., by a heavy storm, with the exception of the electric railway conductors. The interruption of telephone and telegraph service, as well as the extinction of the electric lights, may no doubt, have been the cause of much inconvenience, but the continued operation of the electric railway, the principal means of transportation, in a large measure compensated for the loss of time and temper occasioned by the failure of the other electric services. The lesson taught, however, is that good construction pays as well in other kinds of electric service as in electric railway work.

Rules for Conductors. WE have from time to time made note of the work done by the Board of Electrical Control in devising rules and regulations for conductors, and this week we publish a complete set of those which apply to overhead wires. It will be seen that altogether 37 rules and regulations are laid down to be observed by any company seeking to do an electric light business, and desiring to employ overhead conductors. We think that the conditions which are to be observed are on the whole such as will commend themselves to the good judgment of the fraternity. In such cases, of course, a great deal depends upon the interpretation which is to be given to these rules, and it will be noticed that a wide discretion is left to the expert of the Board. From the care with which the rules and regulations have been drawn up, it is clear that, for some time to come, the Board expect to have a large number of overhead electric light and power conductors to look after.

New York Telephone Rates. IT might have been expected that the last legislative investigation into telephone rates in New York city and other parts of the State would be quite sufficient to satisfy most people that the rates were not not very much out of the way. It appears, however, that the New York Board of Trade is still dissatisfied, and that it has appointed a special committee of five to introduce a bill to bring down rates in the city, and to break up the formidable lobby which it is said is maintained at Albany by the telephone interests. The idea occurs to us that perhaps if the telephone companies, insurance companies and others were not so subject to "strikes" and raids, in the shape of bills before the legislature, those companies would not have much to fear from what was going on at Albany. It is cynically cruel to aim a blow at a man's head with a bludgeon and then accuse him of pugilistic tendencies when he involuntarily puts up his arm to defend himself. The companies are systematically attacked and yet commit an unpardonable sin in striving to protect themselves.

The Price of Copper. SOME interesting figures have been published as to the effect of the copper corner in enhancing the value of stock in copper companies. A list of about a score of Boston concerns in one of the commercial papers estimates an inflation of not less than $22,000,000 within a few months as the result of their participation in the profits of the pool. It is to be remembered that these profits represent a tax on the industries using copper, in so far as they accrue from prices above the legitimate value of the metal on the basis of normal supply and demand; and in some industries this tax makes itself more seriously felt than in others. In electrical applications the "corner" has been an important element to deal with, and the new conditions are not yet all realized. It might not be unjust to attribute, for example, the recent advance of about 15 per cent. on insulated wire to the advance in copper, the manufacturers seeking a new adjustment to the state of the market; while the sudden development of the alternating system may also in a measure be traced back to the influences exerted by the Secretan copper syndicate. Just where this will all end no one knows, but there will be one offsetting advantage in the stimulus given to invention and to more economical methods of manufacture.

The Evolution of Discovery. IN a pithy little article in the current number of the *North American Review*, Mr. Charles Barnard, the well-known writer on scientific and industrial topics, deals with the evolution of discovery as suggested to him in turning over one of Mr. Edison's scrap books lately. Among the items preserved there is one from a gas journal to the effect that Mr. Edison's dream of incandescent lighting was never to be realized, as being beyond the range of the possibilities. From this Mr. Barnard argues for a generous, sympathetic frame of mind toward the new things that science and invention bring to us, and he raises the interesting question whether the greatest progress in both invention and discovery may not eventually spring from the improvement of our senses. "It is fair to suppose that our senses are improving, and that the time will come when we shall apprehend things to which we are now blind, deaf and insensible. We only know what our senses tell us. What if we may some day see, hear and feel far better than now! We cannot see the invisible ends of the spectrum. What might we learn if we could? We cannot hear below the 16-foot tone or above the treble of an insect. What might we not hear if we could hear more? There is no apparent limit to the evolution of our physical being. Meanwhile we may accept new things in a spirit of expectant attention, ready to believe, glad to be convinced when any fact is made useful, and yet hesitating to accept claims of new discoveries made by men whose senses are no better than our own. A thousand horse-power in a teacup is senseless, because beyond sense. Speech by wire is sensible, because within the range of sensation." Taking the cue from Mr. Barnard, we may ask whether it is not the refining of our senses that makes every one prefer the electric light to gas or oil, or that causes us to find the horse car and the steam car so objectionable in cities. Those are practical, concrete examples of improvement. On the other hand, with new inventions may come a neglect and deterioration of physical function; but while we have the best artificial means of locomotion known we are still raising the record in pedestrianism.

Electric Lighting in England. THE reproach which has long existed regarding the backward state of electric lighting in England is at last to be removed, and, indeed, we might have expected a strong reaction from the lethargy which has prevailed in the industry in England during the last few years. At the outset, the condition of electric lighting there was made precarious, as far as the central station was concerned, by the celebrated Electric Lighting Act, which, drawn up in the interests of the gas stockholders, put an effectual damper upon all those who would willingly have invested money in electric light enterprises of this nature. Now that some of the onerous restrictions have been removed, we note the reaction, and indeed it is more marked than we would have supposed possible in a country so conservative. There is now in progress in London an installation which is calculated to exceed many times in capacity any other existing electric light installation in the world, and on another page we give some of the most important details of this herculean enterprise. An undertaking of this sort naturally brings with it considerable novelties of construction, and perhaps the most striking to be found in this particular one is the method, or rather the means, employed for the carrying of the current. We cannot but view with combined admiration and apprehension—admiration for the boldness, and apprehension for the success of—the employment of a potential of 10,000 volts, with one side of the circuit bare and exposed to ground contacts at innumerable points; in fact, designedly grounded. This means, in fact, an absolute insulation at every point in the circuit, and whether, in the light of past experience even with currents of far less tension, such a state of affairs is a practical possibility remains to be seen. In fact, we can here only re-echo the statement of one of our foreign contemporaries, which remarks that this project must either be a gigantic success or a gigantic failure For the sake of electric lighting generally, we hope that the scheme will prove successful. Mr. Ferranti, with the courage of youth, and borne up by firm conviction, has inaugurated a departure in electric lighting, which, if successful, must place him at once among the foremost electrical engineers of our time. Naturally, the carrying out of so great an enterprise has filled the breasts of our British friends and contemporaries with glee at the thought that, at last, England will be able to show up something in the electrical line that shall "beat the Yankees." In fact, so confident do the promoters of the enterprise seem, that it is hinted similar work will soon be undertaken by the same parties in this country, in a large city. America is not a country that looks with disfavor upon anything good, even though it be of foreign origin. On the contrary, if the system shall prove successful abroad, there is no reason why it should not find a very kindly reception on this side of the water. After all, Mr. Ferranti, with his two million light station, makes the nearest approach yet gained to the proper wholesale basis of the supply of current and lamps.

Some Novel Telephone Apparatus.

Among a number of different patterns of telephonic apparatus made by the Consolidated Telephone Construction and Maintenance Company, our contemporary, the *London Electrician*, illustrates those shown in the accompanying engravings. In Fig. 2 is shown a complete set composed of transmitter and receiver intended to be worn by a diver under his helmet. The receivers cover each ear, while the transmitter is fitted in a recess near the mouth. Fig. 1 illustrates the arrangement at the shore end of the diver's telephone, at which a battery transmitter is employed. A large number of these sets have been supplied to the English Admiralty, and have been used with great success.

A New Time Switch for Lamp Circuits and Secondary Batteries.

In the distribution of electricity from central stations while current is on continuously, there are many cases in which individual consumers require current for light or power only during certain fixed periods. Thus a consumer may wish to use his electric lamps only between stated hours, or he may have one set of lamps which he wishes to have constantly available, while another set—such as those in a store window—may be only required for certain hours. The same is true with regard to motors. Furthermore, in charging storage batteries the circuit is usually thrown on to the batteries at a certain hour and thrown off at another fixed hour.

In order to accomplish the object of throwing the lamps, motors or batteries into and out of circuit at the proper stated intervals, Mr. W. F. Stocker, of Burrton, Kan., has invented the time switch, illustrated in the engraving, Fig. 1; and Figs. 2 and 3 show the arrangement of the circuits for a lighting system and storage battery, respectively.

As will be seen, the lamps *B B* are arranged to be always available. The derived circuit, which includes the lamps *C C*, also includes mercury cups *D D*, which become elec-

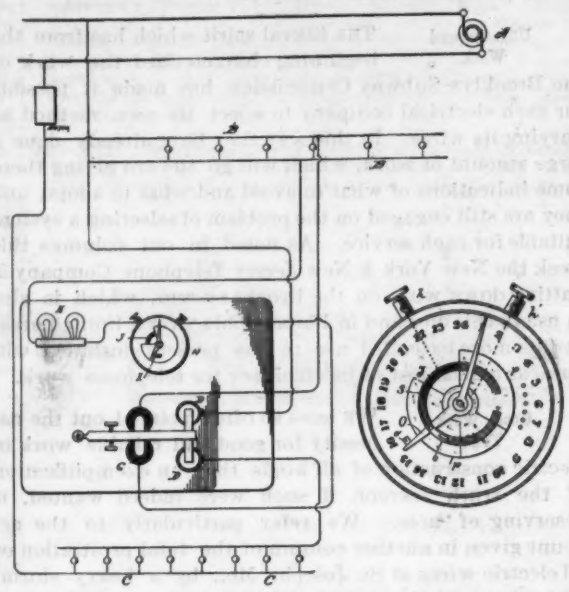
FIG. 1.—PORTABLE TELEPHONE SET.

trically connected by a yoke attached to the armature opposite the electro-magnet *G*, when the latter is energized. Thus when the armature of the magnet *G* is unattracted, the circuit of the lamps *C C* is broken; but it is closed when the armature is down to the poles. The circuit of the magnet *G* is taken from the two sides of the derived circuit, including the lamps *B B*, and this circuit is closed periodically by the time-switch *H* whenever the clock-moved arm or pointer *I* comes in contact with the platinum strip *J* on the dial face. This circuit is usually closed through one or more incandescent lamps *K*, to reduce the current to the proper strength. Supposing the lamps *C C* are arranged in a store window and the proprietor wishes them to be burning from eight to twelve in the evening. By means of the clock, switch arm *I* will be in contact with the strip *J* only between those hours, thereby operating automatically to cut in or out the lamps at the proper times.

The switching apparatus shown in Fig. 2 consists of a clock-work having a dial face marked with the hours from 1 to 24. A clock adapted to make the circuit of the dial once in twenty-four hours is preferable, as otherwise the apparatus would do its work once every twelve hours, which, in general, is not desirable.

The clock-work shown is provided with two binding posts *h* and *h'*, the former of which is connected with a circular strip *J* of platinum, secured to the dial face and the latter to the clock-work itself, or to the hands which traverse the dial, the platinum strip being insulated from the hand or from the clock-work, as the case may be. The dial face itself is made of insulating material and the strip secured upon it, and there is connected with the hour hand *O* of the clock a spring strip *o*, which makes contact with the platinum strip when not impeded. Between the hands and the dial are half discs *p* and *p'* of mica, which are adjustable in such a manner with respect to each other as to leave just as much or as little of the platinum strip as may be desired exposed. According as these half discs are adjusted the follower *o* will remain in contact with the spring *i* a longer or shorter time. It is evident that by various adjustments the times when the follower shall come in contact with the spring can be varied, as can also the duration of contact.

In Fig. 3 are shown the circuits for automatically throwing a secondary battery in and out of a charging circuit. In this case there are two sets of mercury cups, and the armature lever supports upon an insulating cross-bar two yokes instead of one. When the circuit is closed at the time-switch, the magnet acts as before, and cuts the battery into the circuit of the dynamo. Only so much



FIGS. 1 AND 2.—STOCKER'S TIME SWITCH.

current is diverted through the magnet as is necessary to hold the armature down. The amount of current in this circuit is regulated by lamps, as described above.

The Use of Mica as a Dielectric.*

BY DR. IGNAZ KLEMENCIC.

These investigations were made to determine the specific inductive capacity of mica, and its suitability for the manufacture of condensers, and the following results have been obtained: The value of the specific inductive capacity is 6.64. The capacity in the case of perfectly dry mica is independent of the charging E. M. F., and was found to increase by only 1.8 per cent. when the time of charge was increased from .002 second to 20 minutes, the time of discharge in each case being .007 second. The specific resistance is not less than 6×10^{21} times the specific resistance of mercury.

But little is to be found in electrical literature on the subject. Fleeming Jenkin found about a 7 per cent. variation of capacity between a momentary charge and one of five seconds. Colley found that the two best out of a number by Elliot varied 10 per cent. under similar circumstances, and Kägi has also done good work on the subject. There can be no doubt that the discrepancies between the results obtained by different investigations are to some extent due to variation in the mica itself, but the author believes that the great differences between his results and those just referred to are to be ascribed rather to the fact that in his observations the mica was absolutely dry. Temperature has also a great influence on capacity; but this has been left for a future investigation.

Determination of the Specific Inductive Capacity.

Two plates of mica were experimented with, 400 square centimetres area, and 0.00508 cm. and 0.0108 cm., respectively, in thickness. The thickness was determined with

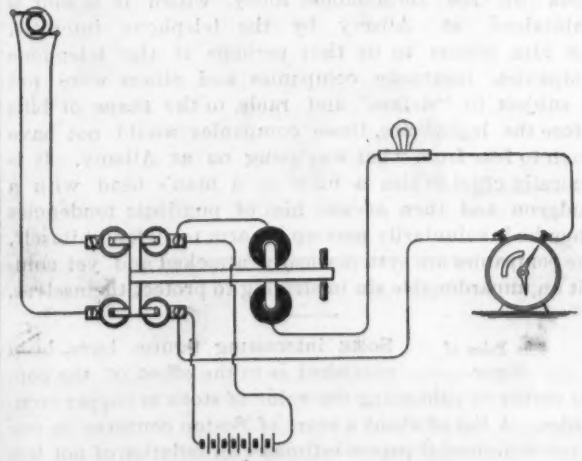


FIG. 3.—STOCKER'S TIME SWITCH.

great accuracy, and the methods employed are described by the author in detail. Each plate was then made up as a condenser in the following way: A perfectly true iron plate 18 by 18 centimetres was electro-plated with copper and amalgamated; it was then carefully dried and cleaned, and placed with its amalgamated side upwards. A few drops of mercury were then poured on, which immediately spread over the whole, forming a pasty but at the same time a firm surface. The mica plate was then slid quickly on, pushing all dirt before it, and leaving a perfectly bright surface of mercury amalgam in contact with its under side. Any air bubbles were at once apparent, and could be worked out by moving the plate about. In the thicker plate some small air bubbles were noticed in the plate itself, but none were observed in the thinner one.

The upper covering was also formed of mercury. A strip of sheet iron, .5 millimetre thick and 1 centimetre wide, was made into a ring about 17 centimetres mean diameter. This was stood on the middle of the mica plate, the lower edge being first tested on a surface plate and made perfectly true, and the upper edge stiffened to prevent deformation. The tube was coppered and amalgamated, as there was otherwise a slight error due to the mercury not touching the iron all round the edge. The diameter was, of course, measured to the *outside* of the tube. The S. I. C. was determined from the formula

$$\sigma = \frac{4\pi d k}{S},$$

where σ = the specific inductive capacity of the dielectric, k the capacity of the condenser, d the distance between the coverings, and S their area.

The capacity was measured by discharge throw compared with that of a known air condenser. To avoid errors due to absorption, both the time of charge t_1 and the time between charge and discharge t_2 were made as short as possible. Hiecke's method with a falling weight was used, t_1 being .00026 sec. and t_2 .007 sec.

Under these condition two tables of tests are given showing for the thin plate $\sigma = 6.74$ at 14° Cent. and for the thick 6.54 at 14.3° C.

When t_1 was made 20 seconds, t_2 still remaining .007, the values of σ rose to 6.97 and 7.07 respectively. This apparent increase is nearly exactly inversely proportional to the thickness of the plates. At the end of each set of readings one was taken with the battery reversed, but no polarization effect was obtained. When continuously charged and discharged for two hours by tuning fork the capacity remained absolutely unchanged.

The 3 per cent. difference in the value of σ for the two plates the author attributes to some slight irregularities

FIG. 2.—TELEPHONE HELMET FOR DIVERS.

which were observed in the thicker one, and possibly to a small error in determining the thickness.

The value found is not in accordance with that of the refractive index according to Maxwell's "Electro-Magnetic Theory of Light," the refractive index for mica being, according to Landolt and Bernstein, 1.6; but as has been often pointed out before, in dispersion formulæ there is no certain method of determining the refractive index for waves of infinite length.

* Abstracted from Exner's "Repertorium der Physik."

Ferranti Alternate Current Motor.

In an alternate current motor recently patented in England by Mr. S. Z. de Ferranti, the inventor utilizes the alternate currents for obtaining motive power, by causing them to pass through a compound apparatus consisting of two electromotors. The principal motor is one without commutator and such that, when running at a suitable speed, it will maintain this speed and synchronize itself with the alternation of the currents passing through it. The other electromotor is of much smaller dimensions; it is provided with a commutator, and is capable of starting from rest when the current is passed through it. The armature of this machine is on the same shaft with the armature of the first electromotor, so that when the circuit is first closed the small motor drives the armature of the main motor, and so brings it to the speed requisite to enable it to work synchronously with the current supplied to it by the circuit.

Filtering Mercury.

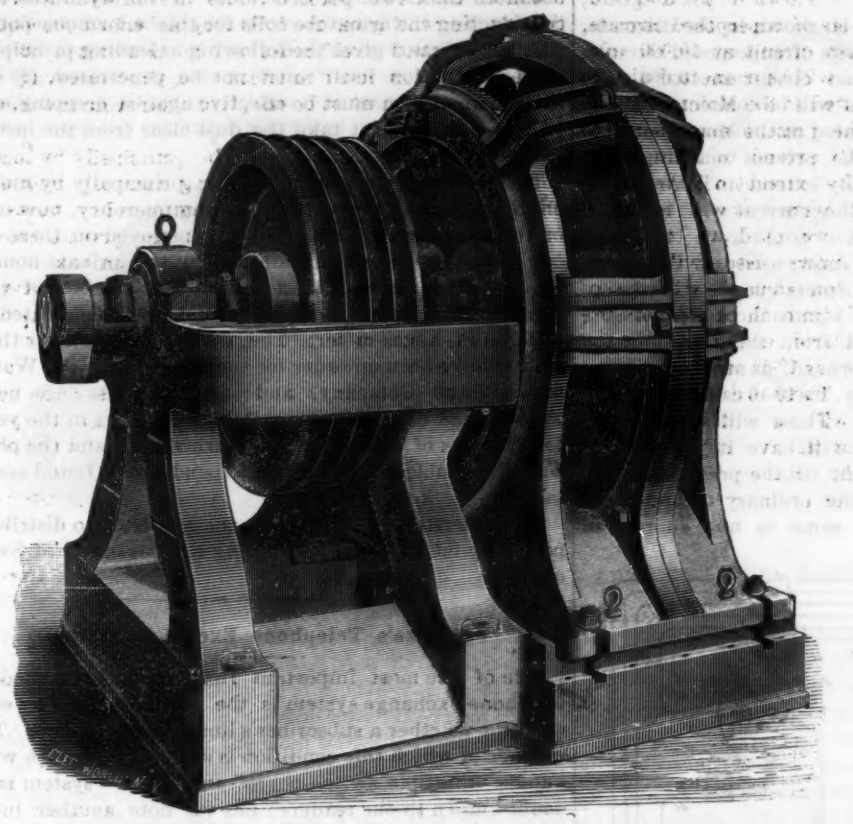
To the Editor of The Electrical World:

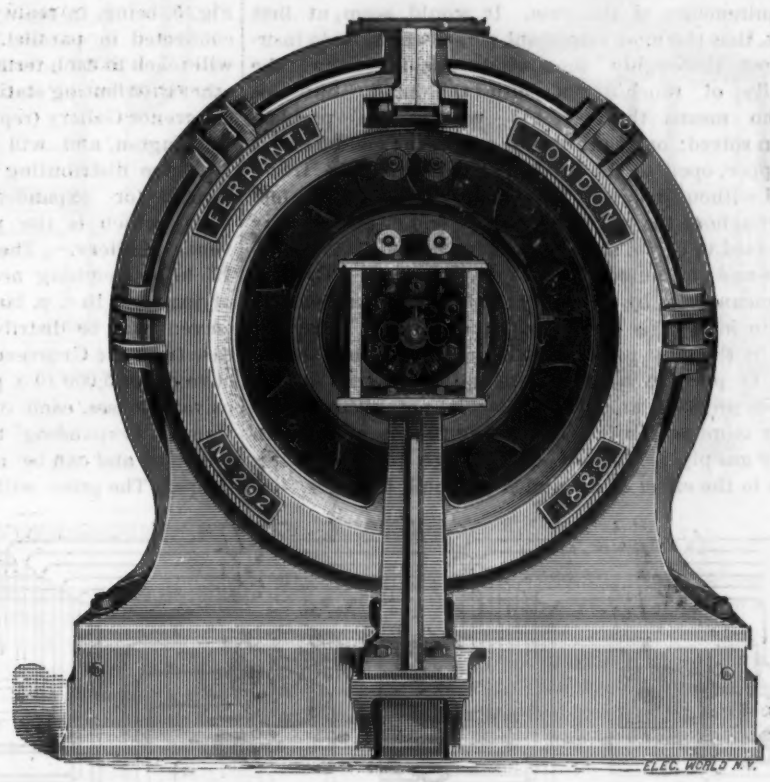
SIR: Noticing an article upon the filtration of mercury, and having had experience with it in laboratory work, I can recommend as the safest and least expensive and most readily used plan, that of pouring the mercury into a piece of chamois skin which is spread loosely over the mouth of a cup, or shallow vessel, the chamois sinking to the bottom as the mercury is poured in. The corners of the chamois are then bunched and twisted after the ordinary manner of a straining cloth, which forces the mercury rapidly through the pores, leaving all impurities behind.

WALTER A. CROWDUS.

The Deptford Central Station Ferranti Alternating System.

In our last issue we described the general arrangement of the Grosvenor Gallery central station of the London Electrical Supply Corporation, from which alternating currents are being distributed by Ferranti machines. We are this week enabled to give more detailed illustrations of some Ferranti machines. Our illustrations show the machine in two views in Figs. 1 and 2, and Fig. 3 shows the magnet skeleton of one side of the machine.





FIGS. 1 AND 2.—FERRANTI ALTERNATING CURRENT DYNAMO.

The machine illustrated is designed for an electrical output of 150 horse-power, and is therefore capable of feeding 3,000 10 c. p. 35 watt lamps. As will be seen there are twenty magnets on each side of the armature, the distance between the pole faces being three-quarter inch. Between the magnets the armature, which is one-half inch wide and has a diameter of 4 feet, makes 400 revolutions per minute and has a peripheral speed of 4,800 feet per minute. The diameter of the armature shaft is 4½ inches. It will be noted the pulley is placed between two bearings and that the armature is overhung.

We have already given a short account of the new Ferranti central station now in course of construction at Deptford, but, as the undertaking is by far the largest of the kind ever attempted, a more detailed description will prove of interest.

The site of the station is near the premises of the General Steam Navigation Company, at Deptford, and is a fine river-side site of about four acres in extent, almost the whole of which, with the exception of a wharf retained for unloading the great masses of machinery and the supply of fuel, will eventually be covered with engines and boilers of great size and most massive construction. The buildings are arranged so as to be easily capable of extension, the boilers being added in the direction of the river and the engines toward the road. A tramway runs from the river side direct into the building for unloading the machinery and material. The company will own their own coal vessels, which will bring the coal direct to the wharf, and from which it will be raised by hydraulic skeps to an overhead tramway running to the coal store, which will be on the top of the building. The building now in course of construction consists of a boiler house and two engine houses, occupying together a space of 210 feet by 195 feet, and having a height from basement to roof of about 100 feet.

The two engine-houses now in course of construction are each 195 feet in length, 66 feet in breadth and 85 feet high. The engine-houses are separated from the boiler house by a massive wall of masonry, and a row of iron pillars of immense strength separate the two engine-houses. These supports are required for support of the roof and the overhead traveling cranes, but beyond this there is nothing to impede the view of the whole of the engines, and the engineer in charge will be able to obtain a comprehensive view of the whole from a gallery especially provided for him.

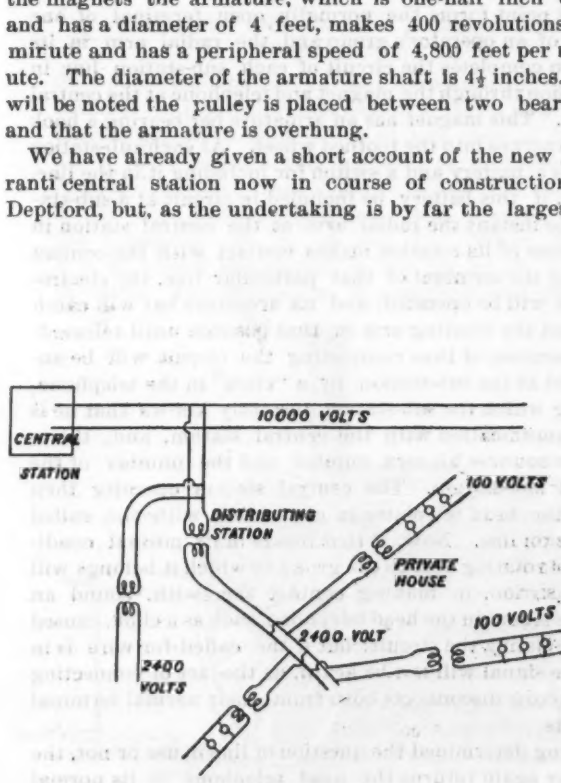


FIG. 5.—DISTRIBUTION FROM DEPTFORD STATION.

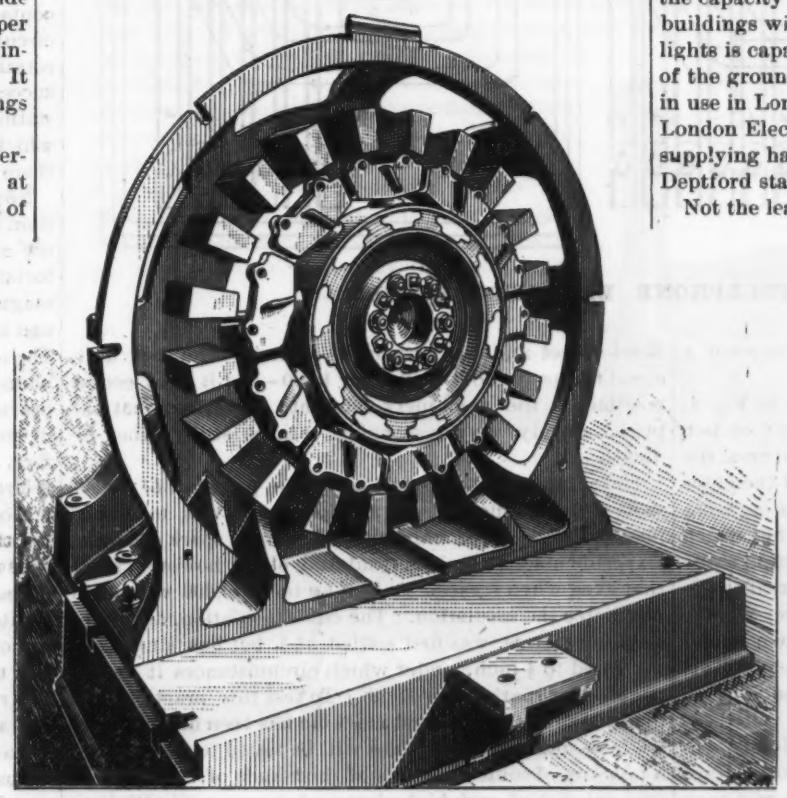


FIG. 3.—MAGNET FRAME, FERRANTI DYNAMO.

The first portion of the plant to be put into position and working order in the first engine house will be two "small" engines of 1,500 h. p. each, connected with rope gearing, forty cotton ropes of 5 inches circumference, with two Ferranti dynamos for 25,000 lights each. These dynamos are by far the largest electrical generators that yet have been constructed. The engines are Corliss engines, constructed by Messrs. Hick, Hargreaves & Co., and will be used for the minimum supply at first. A steam traveling crane, 60 feet overhead, will traverse the engine room from end to end, capable of lifting twenty-five tons. Beside the machinery mentioned, the first engine-house will contain the exciting dynamos, hydraulic gear, and the condensing apparatus. In addition to this, the second engine-house contains the "large" dynamos, each of which will be driven, when at ful power, by a pair of vertical Corliss engines, coupled direct to the dynamo, of 10,000 h. p. There will be two dynamos of this size first installed. but at present they will be driven by only one out of their pair of engines, being 5,000 h. p. each, and giving with this power 100,000 lights each. Eventually, as the demand increases, the second engine to each dynamo will be added, each dynamo being capable of supplying a total of 200,000 lights. As the demand still further increases, this plant will be used for the day work, and two other 10,000 h. p. engines and dynamos will be put down. For the manipulation of the heavy pieces of machinery for these machines an overhead traveling-crane will be erected similar to that in the first engine-house, but capable of lifting 50 tons. After the capacity of the present buildings is exhausted, fresh buildings will be constructed, and a total of two million lights is capable of being supplied from the present area of the ground. As the total number of lights at present in use in London is somewhere about five millions, the London Electric Supply Corporation evidently contemplate supplying half this total number, eventually, from their Deptford station.

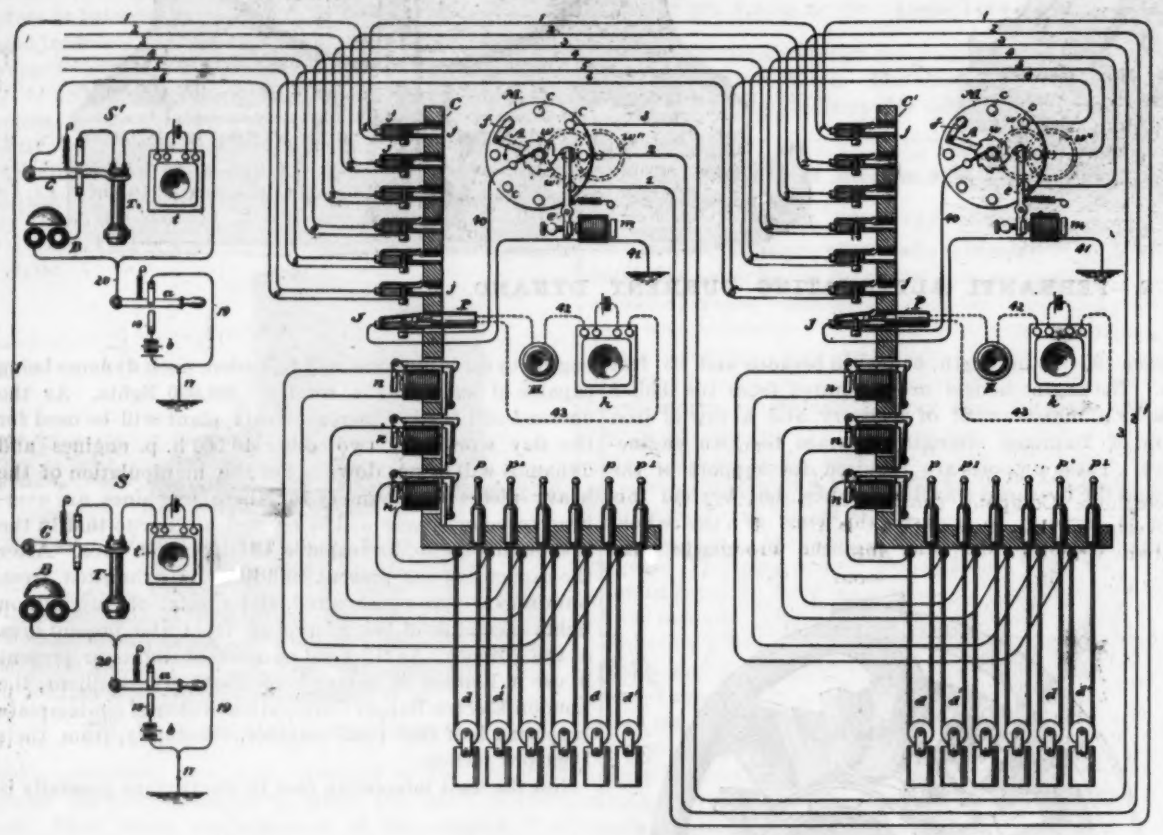
Not the least interesting fact to electricians generally is the statement that throughout the installation instruments and switch-boards will be practically absent. The only instrument in use will be a single Cardew voltmeter, connected to a test transformer circuit used to light the offices of the works. Possibly an ammeter will be inserted occasionally for their information in the main circuit to test the actual current, but this is not necessary for the working of the installation, the regulation of which is entirely effected by the governors of the engines.

FIG. 4.—CROSS SECTION OF FERRANTI CONLUCTOR, DEPTFORD.

Another important feature with regard to the safety of men working upon the place, is that the whole of the dynamos will be enclosed and magnetically locked by the exciting current, so that it will be impossible, even if it were attempted, to get a shock from the dynamos themselves. The metal lid of the box surrounding the brushes

is so arranged as to form part of the exciting circuit; no one can open the box while the exciting current is on, and the exciting current cannot pass while the box is open. To excite the dynamo, it is necessary to close the box, and in so doing it is magnetically locked, so that the brushes cannot be touched while the dynamo is working.

One of the most important and interesting details of such a scheme of high-tension distribution at 10,000 volts is, of course, the conducting cable; and here, as in other details, no precedent was obtainable for such high voltages, and Mr. Ferranti had to invent his own cable to suit the requirements of the case. It would seem, at first thought, that the most important point would be to insulate most thoroughly the whole cable from the possibility of touching it with the hand. But this is by no means the way in which the problem has been solved; on the contrary, one of the conductors is bare copper, open to the air, and which may be freely handled without danger. This is accomplished by the fact that throughout the whole system one end of the primary is connected to earth, and the difference of potential between it and any human body is therefore nil. By this simple means, and by enclosing the high pressure end of the main inside this outer copper conductor, separated from it by the most perfect insulating compound obtainable, it is possible to distribute the electricity at this enormous pressure, and yet render it not necessary to take any more precautions in running the main than an ordinary gas-pipe. The danger in high pressure wires consists in the effect of a number of small leakages, but



THE VAN SIZE TELEPHONE EXCHANGE SYSTEM.

with these concentric cables there is nothing between a dead breakdown and perfect safety.

The section of the conducting main is shown in Fig. 4, from the London *Electrical Engineer*. It consists of two concentric copper tubes of the same total sectional area, the inner one of pure copper $\frac{5}{16}$ in. in thickness, and the outer one $\frac{5}{32}$ of an inch. Between this is an insulating compound, the nature of which is not explained, but which consists of an ordinary insulating substance, costing a few pence per pound, but specially treated under great pressure. This is placed upon the inner tube, and over this the outer tube is slipped, and is then drawn down under pressure until the whole is one solid mass. This cable will be made in 20 feet lengths, and by a special joint can be connected together with as little labor as a gas pipe. The difficulty in such high-pressure joints is that due to surface leakage, and to obviate this it is necessary to have a very long surface insulation joint, and by a special arrangement of joint this is very simply performed by a single operation, giving about 2 feet of surface insulation, and without baring more than 4 inches of the cable. The total diameter of this cable is $2\frac{5}{16}$ inches, and the current to be sent is at the rate of 330 ampères per square inch, which is sufficient with one cable to supply 100,000 lamps of 10 c. p. The voltage loss on all mains is very small, less than 3 per cent. over all, and the retardation is stated to be quite negligible—less than $\frac{1}{4}$ per cent.

In order to get the supply of electricity from the central station to the points of distribution in London, the very brilliant idea has been carried out of utilizing the lines of the various railroad companies running into London from the south, so that the high-pressure mains will be able to radiate from every railway terminus from Cannon street to Kensington. After long experiments, undertaken to convince the companies of the absolute safety of the mains, contracts have been entered into with the Brighton, the South-Eastern, and the Chatham and Dover railways, to bring the high-pressure mains along the lines into their stations, and also to run the mains underground along the District Railway. Two main cables will be brought to each of the following, viz.: Cannon street, Ludgate hill and Charing Cross, and distributing stations, consisting of buildings with cellars and roof, abutting on to the railways, will be prepared for the reception of the cable ends and for the secondary transformers.

The principle of distribution is shown in the diagram, Fig. 5, being, in reality, three sets of superposed circuits, connected in parallel. The first circuit at 10,000 volts will reach to each terminus, and will be connected also to other distributing stations situated at the Monument, the Grosvenor Gallery (replacing the present machinery), to Kensington, and will eventually extend to Hampstead. At these distributing points the current will be transformed (or expanded, as it were,) down to 2,400 volts, which is the pressure now used at the Grosvenor Gallery. The transformers used will be of 125 h. p., weighing nearly one ton, each capable of supplying 2,500 10 c. p. lamps, and from these stations the current will be distributed overhead, as at present is the case from the Grosvenor Gallery, by 19-15 cables, carrying current for 5,000 10 c. p. lamps. These will be led to the private houses, each of which will have its own transformer, "expanding" the current till the pressure is only 100 volts, and can be used in the ordinary incandescent lamps. The price will be the same as now charged in Bond street and neighborhood—namely, 7½d. per unit, equal to gas at about 4s. 2d. per 1,000—and it is of course possible, as the machinery gets into operation, that the price, already very reasonable, may be still further reduced.

The actual spark through air of a potential of 10,000 volts is ¼ of an inch, and an experiment was made and photographs taken, showing this ¼-inch spark in space. Experiments with ebonite insulating plates, however, show that even when scraped to $\frac{1}{32}$ of an inch, 10,000 volts will not pierce the insulation. The cable insulation, as will be used in practice, was first settled at ⅛, but has since been increased to ¼ inch, under which circumstances it is impossible for sparking to occur. To test this practically in manufacture a Wimshurst machine has been made to give a 6-inch spark, and all cables will be tested to stand this—a pressure of some hundreds of thousands of volts. In the transmission of such high electrical pressures, Sir William Thomson has shown that the interior of a solid copper rod is practically useless, and the weight of the inside copper is thrown away. The cables are therefore both made cylindrical, the inside one of sufficient diameter to insure a practical result.

The following are a few of the details of the Ferranti dynamos: The small machines will be 12 feet 6 inches high, 15 feet over all; the large machines will be 45 feet high over all, and will weigh 500 tons each. The number of alternations of current will be 4,000 complete cycles per minute (67 per second) in all machines. In the small machine there will be 48 poles, and the speed 168 revolutions per minute. The large machines are to be coupled direct, and the speed is 60 revolutions per minute only, the peripheral speed being obtained by the largeness of their diameter. The coils of the dynamos are built up in the same manner as an ordinary dynamo's, each coil generating 125 volts. These are very strongly mounted mechanically, and most carefully insulated, the principle being to bury the conductors in the insulation. The insulation used is sulphur, specially treated, and is so hard that in one case where some metal was found to be mixed with the sulphur it took two days to chip out one coil. The sulphur eats partially into the cast iron and bronze, and makes a thorough joint. Besides this, the surface insulation is carefully arranged to be of porcelain throughout. The electrical efficiency of the armature is very great, two volts being obtained for every foot of copper. There is not more than two per cent. loss in the dynamos. In constructing the armature coils for this enormous potential, Mr. Ferranti gives the following as leading principles: (1) the insulation itself must not be penetrated, (2) the surface insulation must be effective against creeping, and (3) the draught must take the dust clear from the insulation.

The supply of electricity will be principally by meter, and Ferranti's meter, with revolving mercury, now used on the Grosvenor circuit, will be employed on these circuits to register the consumption in the private houses. The meter is inclosed in a round cast-iron box of very moderate dimensions, and the current used is indicated on dials, as in a gas-meter. The trains of wheels for these meters have been on order for some time with the Waterbury Watch Company, and arrangements are made by which, at eight hours a day for 300 days in the year, 15,000 trains of wheels can be turned out, and the plant could be doubled at a moderate expenditure if found necessary.

We understand that it is also contemplated to distribute power by means of an alternating current motor of Swiss origin.

Van Size's Telephone Exchange System.

One of the most important functions of the modern telephone exchange system is the determination by each operator whether a subscriber's line is in use or not. The manner in which this condition is determined in the well-known "multiple switch-board" and "Law" system is no doubt known to our readers; but we note another interesting and novel method of determining the condition of a telephone line in an arrangement recently patented by Mr. Wm. B. Van Size, of this city.

In this system the inventor places a series of fixed insulated contact points equal in number to the number of circuits in an operator's group in close proximity to each board. These points are arranged in a circle, and at the centre is placed a rotating radial arm. This arm is upon a constantly rotating shaft, which also bears a wheel having a series of teeth, one for each contact point. This arm is connected to ground through a short conductor containing an electro-magnet and a head telephone. Each fixed contact point forms the normally open terminal of one circuit of an operator's group and the radial arm in its rotation completes the circuit of each sub-station line in succession through the magnet and telephone at the central station. This magnet has an armature bar bearing a hook which catches into the toothed wheel. At each sub-station there is a battery and a switch for including it in the line.

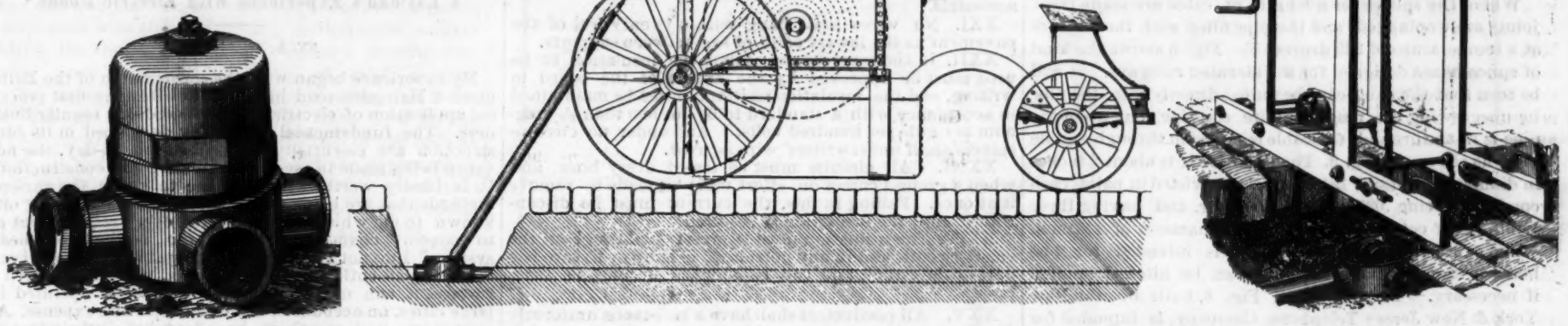
Now, if this battery be included in circuit at a sub-station, the instant the radial arm at the central station in the course of its rotation makes contact with the contact forming the terminal of that particular line, the electro-magnet will be operated, and its armature bar will catch and hold the rotating arm in that position until released. The operation of thus completing the circuit will be announced at the sub-station by a "click" in the telephone, hearing which the sub-station instantly knows that he is in communication with the central station, and, therefore, announces his own number and the number of the desired sub-station. The central station operator then places the head telephone in connection with the called for station line. Now, if that line is in its normal condition the rotating arm to the group to which it belongs will in its rotation, in making contact therewith, sound an audible signal in the head telephone, such as a click, caused by completing the circuit; but if the called-for wire is in use, the signal will not be heard, as the act of connecting two circuits disconnects both from their normal terminal contacts.

Having determined the question of line in use or not, the operator again returns the head telephone to its normal position in connection with the radial arm. Assuming that the called-for line was found idle, the operator takes up two jack plugs united by a flexible cord, including a ring-off annunciator, and inserts them in the calling and called-for lines, respectively. The insertion of the plugs opens both lines in the jack and cuts off connections with the rotating radial arms, when in every case, the arm of the calling-line having been stopped, it immediately resumes its rotary movement and thus continues until again stopped.

The accompanying diagram illustrates the new arrangement. As will be seen, *C C'* are two duplicate switch boards located at the exchange and connected with sub-stations *S S*, etc., through the conductors 1, 2, 3, etc. Each conductor has a spring-jack *j* on each board *C C'*. A subdivision of the aggregate number of circuits terminates in a series of fixed contact-points *c c*, located in close proximity to each board. These points are arranged in the circumference of a circular disc of insulating material *M*. At the centre of *M* is placed a

radial arm of conducting material *A*, having a flexible trailer *f*, which makes contact successively with the series of contact-points *c*. Fixed to the same shaft with arm *A* is a toothed wheel *w*. The teeth in the wheel and the contacts *c* in the circumference of the circle are equal in number and correspond in radial position. The arm *A* and wheel *w* are motor-driven, the movement being equalized and regulated by power-driven intermediate wheels *w' w''*. A short conductor 40 41 connects this radial arm *A* with the earth. Included in the conductor 40 41 is a special spring-jack *J*, and an electro-magnet *m*. This magnet *m* has a hooked armature-bar, the hook being in position to engage with any tooth of wheel *w* whenever the magnet is energized by a current. A head telephone *H*, and a transmitter *h*, have their terminals connected to a jack-plug *P*, and can be included in the conductor 40 41 by inserting plug *P* in jack *J*; or the plug *P* may be inserted in any of the series of jacks *j* for the purposes of including the head telephone *H* in any circuit 1 to 6. Flexible cords *d d'* are connected to terminal spring-jack plugs *p p'* through the ring-off annunciators *n*.

At the sub-stations *S S'* there is the usual arrangement of gravity-switch *G*, receiving-telephone *T*, and transmitter *t* in a telephone-branch, and the call-bell *B* in the bell branch. In place of a magneto-bell there is a constant current generator, such as one or two cells of battery *b*, and a hand-switch *a*, for including or excluding it with respect to the main line. When the switch *a* is in its normal position, the circuit is *via* the conductor 20, *a*, 19 and 17. When the lever *a* is depressed the circuit is *via* 20, *a*, 18, *b*, and 17, to earth. The magnet *m* is energized and attracts its armature, bringing the hooked armature-bar *e* into engagement with wheel *w*, which instantly stops, *f* remaining in contact with line *l*. Sub-station *S* hears a stroke on the bell *B*, which he understands to be the completion of his circuit, and he knows that he has the exclusive attention of the central-station operator; if the sub-station has removed his telephone he hears the stroke or click in his telephone, instead of on the bell. In either case he immediately announces the number of his own station and that of the station with which communication is desired, which the central station operator receives upon head telephone *H*. Sub-station *S* retains lever *a* in a depressed position until he hears the called for station. The central station removes the plug *P* from the jack *J* and inserts it in the jack of the called for line to ascertain whether that line is in use or idle. If the line is idle, there will be heard a click in the telephone, caused by the arm *A* at the board *C'* completing the circuit of line 6, which it should do once every two seconds. If no sound is heard, it is an indication that the called-for line is severed at some point outside the terminal *c*, which would be the case if a jack-plug had been inserted in any jack *j* in circuit 6. Assuming that the circuit was not in use, the operator inserts plugs *p p'* into the circuit of the calling and the called-for stations, respectively, thus joining the two circuits into one, cutting off connection with the contact points *c c*, and including a "ring-off" annunciator in the connected circuit. The sub-station releases the switch-arm and the battery is withdrawn. The arm *A* of the calling-station group has been released and the central station operator returns the head telephone *H* to the short line 40 41, ready to receive the next call.



FIGS. 1, 2 AND 3.—LAYING THE BROOKS UNDERGROUND SYSTEM, BROOKLYN, N. Y.

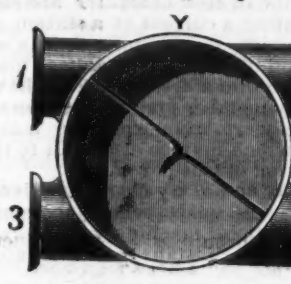


FIG. 8.—LAYING THE BROOKS UNDERGROUND SYSTEM, BROOKLYN, N. Y.

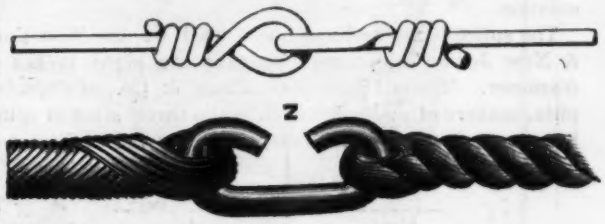
The Brooks Underground System in Brooklyn.

The Brooks system of underground telephone conductors now being laid in Brooklyn by the New York & New Jersey Telephone Company consists in saturating the textile covering of the cables with a mixture of rosin and rosin oil and drawing the cables into the wrought-iron pipes. The pipe is first prepared by scouring the inside sufficiently to remove the sharp edges or protuberances, and reaming the sharp ends in order that the covering of the cable will not be abraded when pulled into the pipes. Instead of using the ordinary socket or coupling, a T-coupling is used. For a pipe 2½ inches in diameter the T is provided with a 1-inch plug, and when the lengths are screwed together the plug of the T points upwards. For every 500 or 1,000 feet length, or such length as may be most convenient, there is a splice box, shown in Fig. 1, and for the length to be pulled in there is another splice box, shown in the ground in Fig. 2, over which splice box there is placed a winch, Fig. 3. When the lengths of pipe are screwed together, the length is beaded over a wire, which is drawn from a reel as each successive length of pipe is added. If it becomes necessary to splice the wire, the splice is made in the form shown in Fig. 4, as an ordinary splice such as is made in a telegraph wire would catch and become fast in the T-joints.

When a sufficient pulling length is formed, a few lumps of caustic lime fresh from the kilns are placed in the splice boxes, the object of which is to dry the air contained in the pipe. Every screw-thread before screwing up is well covered with a mixture of white lead and linseed oil, such as is used to make an ordinary screw-joint moisture proof. The pipe is the common lap-welded wrought iron; the wire left in the pipe is for the purpose of drawing in the rope which is used for pulling in the cable.

Figs. 5 and 6 show two different cauldrons for heating the mixture and boiling out the moisture from the textile covering. Common rosin of the heaviest quality is broken up and thrown into the cauldron, and for a barrel of rosin there is added a barrel of rosin oil. The oil is known in the trade as "London oil" or "kidney oil." The cost of the rosin is about $1.50 per barrel; the oil costs about 11 cents per gallon.

When sufficient of this mixture is placed in the cauldron to cover the cable, the fire is kindled underneath, and the contents of the cauldron heated to about 360 Fahrenheit. As soon as the fire is kindled, the end of the cable to be pulled into the pipe is deprived of this covering, and the wires made bare. This is done by placing a wet cloth or waste about 18 inches from the end and then singing the covering of the wires, and a loop is made with a link to hook into the rope, Fig. 7. This link is of such dimensions that it can pass through the pipe, and the pipe prevents the rope or cable from becoming detached. This is done before and not after boiling, as it would keep ten or twelve men waiting ten or fifteen minutes to get ready to pull in. When the mixture is heated to above the boiling point of water, 212 F., yellow or red bubbles begin to rise and float over the surface until the moisture is all evaporated. The heat is carried to about 360 degrees F., and remains at that point until all floating bubbles cease. It takes two hours or more after the heat has reached 360 F. in the liquid for it to penetrate the coil of cable sufficient to drive out all moisture. When the floating bubbles cease to show themselves, the cable is ready for pulling into the pipes, as shown in Fig. 2. In some cases fresh lime is pulverized in a mortar and introduced into each T-joint, which prevents the cable from adhering or sticking to the pipe when pulled in, and if that is not done, about a gallon of common illuminating oil, such as coal oil or kerosene, is put into



FIGS. 4 AND 7.—LAYING THE BROOKS UNDERGROUND SYSTEM, BROOKLYN, N. Y.

FIGS. 5 AND 6.—LAYING THE BROOKS UNDERGROUND SYSTEM, BROOKLYN, N. Y.

the highest points of the pipe, and this keeps the cable from adhering to the pipe, as the rosin and rosin oil mixture is an exceedingly sticky substance. Two men with a winch, as shown in Fig. 3, can pull in 500 feet in 20 minutes, but with horses, and without the aid of a winch, 520 feet was pulled in in Brooklyn in 5 minutes.

After the cable is introduced, and after the splices are made in the splice boxes, the mixture is drawn from a spigot in the cauldron, Fig. 5, heated at a temperature of 400 F., and turned on to the splices until no more of the mixture can be introduced at that point. The splices are wrapped on the outside with a piece of canvas or coarse cloth, so that none of the splices will touch the iron of the boxes; otherwise, the hot mixture will not drive away the moisture left on the splices from the hands of the splicer.

When the splices for a length of cable are made the T joints are unplugged, and the pipe filled with the mixture at a temperature of 360 degrees F. Fig. 8 shows the kind of splice boxes designed for the elevated railways. It will be seen that the cable can be pulled directly into the pipe by unscrewing the plug opposite the pipe, but when the pipe is in the ground, the cable is pulled in through a guide pipe, as shown in Fig. 2. The cable itself is about 2 inches in diameter, contains 124 conductors twisted in pairs, each conductor being .035 inch in diameter, and having three windings of cotton giving an outside diameter of .125 inch.

The cauldron, shown in Fig. 5, is intended for one horse to move, but another horse can be hitched tandem if necessary. The cauldron, Fig. 6, built by the New York & New Jersey Telephone Company, is intended for two horses. This cauldron is provided with a crank, as shown in the figure, for winding the cable on to the drum.

The cauldron, Fig. 5, has holes in the flanges, and is made to revolve by the use of a stout wire bent in the form of a hook with a suitable handle, as everything in the way of pulling in should be done when the temperature of the cable or the contents of the cauldron is at 360 degrees F. If the cable is to be handled, it is done with suitable tongs, and if the weather should be unfavorable or damp, moisture, in the shape of drops of rain, when it comes in contact with the cable while being pulled in, is immediately turned into vapor and does not affect the insulation.

The splice boxes or hand holes used by the New York & New Jersey Telephone Company are eight inches in diameter. Messrs. Stanley G. Flagg & Co., of Philadelphia, makers of malleable iron, make three sizes of splice boxes, one 8 inches in diameter, one 10 inches in diameter, and one 12 inches.

Rules and Regulations for Overhead Conductors for Electric Light and Power.

We publish below the complete rules and regulations just issued by the New York Board of Electrical Control:

I. No two lines of poles bearing conductors of a like class shall be erected on any street or avenue.

II. No two lines of poles shall be erected on the same side of any street or avenue.

III. Poles shall be set in the sidewalk twelve inches from the outside of curb, and no pole shall be placed within ten feet of any lamp-post or other pole, except at street corners where necessary in order to support wires running on the cross street.

IV. All poles now standing, or to be hereafter erected, shall be branded or stamped with the initials of the company owning them, at a point not less than five nor more than seven feet from the street surface; and when a pole is occupied by wires belonging to more than one company, each group of cross-arms, or where necessary the support of a single wire of different ownership, must be distinguished by some characteristic paint, mark or fastening.

V. Electric light lamp posts shall be in accordance with the plan adopted by the board.

VI. All poles erected for the purpose of carrying lines of more than two electric light or power wires shall be at least forty-five feet high, uniform in size, straight and painted from top to bottom—a very dark color from the sidewalk to a point eight feet high, and a dark green color above that.

VII. All poles for carrying not more than two electric light wires shall be twenty-five feet high, straight, uniform in size, and painted from top to bottom—a very dark color from the sidewalk to a point eight feet high, and a dark green color above that.

VIII. Cross-arms shall be uniform in length, strengthened by braces, and painted the same color as the poles; the cross-arms of each company being distinguished by some characteristic mark.

IX. Each line of poles must be run on one side of the street only, except when absolutely necessary to change to the other side; but this may only be done by the permission of the board or of its engineer or expert.

X. Electric light conductors must not be placed upon fixtures erected or maintained for supporting wires of the other class, namely those for signaling, except by permission of the board.

XI. Poles shall be uniformly spaced, and about sixty to the mile. This requires on the short city blocks of two hundred and sixty feet, alternately three and two poles to the block.

XII. All conductors shall be secured to insulating fastenings, and covered with an insulation which is waterproof on the outside and not easily worn by abrasion. Whenever the insulation becomes impaired it must be renewed immediately.

XIII. No wire shall be stretched within four inches of any pole, building or other object without being attached to it and insulated therefrom.

XIV. Every wire must be distinguished by a number plainly marked on each cross-arm under the insulator.

XV. No unused loops from electric light circuits shall be allowed to remain after lamps are taken away, except in cases where it is positively known that the lamp will be required again within three months, and where there is no underground conduit for that class of circuits.

XVI. All arc lamps must be so placed as to leave a space underneath of nine (9) feet clear between lamp and sidewalk.

XVII. All wires must be stretched tightly and fastened to glass or porcelain insulators, approved by the expert, with a strap of the same kind of wire.

XVIII. All connections with lines of electric light conductors shall be made at right angles to the same; and connections to buildings shall be run straight across to the building and then down the front of the building.

XIX. All joints must be as well insulated as the conductors, and the insulation of joints shall be maintained.

XX. Every line entering a building shall be controlled by a cut-off, placed near the entrance, in sight, and easily accessible.

XXI. No wires shall hang within twenty feet of the pavement at the lowest point of sag between supports.

XXII. In the construction of lines the insulation to be used must be approved by the expert of the board in writing, and the insulation resistance must be maintained in accordance with a standard to be not less than $\frac{1}{50}$ megohm per mile per hundred volts. And under no circumstances shall underwriters' wire be used.

XXIII. All circuits must be tested every hour, and when a ground comes on, effort must be made to remove it at once. Failing in this, the current must be discontinued until the insulation is restored.

XXIV. The insulation must be preserved throughout the entire circuit, and if any portion of a lamp or fixture is a part of the circuit and can be touched, it must be insulated.

XXV. All conductors shall have a resistance uniformly distributed of not more than 30 ohms per mile per ampère, and proportionately less for heavier currents.

XXVI. All existing regulations of the local authorities in regard to the placing of poles and stringing of wires are to continue in force, except when in conflict with these rules; and the rules and regulations of the New York Board of Fire Underwriters must be strictly observed.

XXVII. The violation of any of the rules and regulations of the board shall operate *ipso facto* as a revocation of the permit held by the company or person guilty of such violation.

XXVIII. Whenever hereafter any company shall be permitted by this board or its successors to erect posts or poles, or other fixtures bearing lamps or other devices, for the purpose of lighting by electricity the streets, avenues, highways, parks or public places of the city, the said permission shall be granted only subject to the following provisions, and the same is hereby expressly made a condition of said permits. At any time when, by action of the city authorities, the contract for lighting any such street or other public place shall be given to another company, the company erecting said lamp-posts shall, on tender of the first cost thereof, yield possession and ownership of the same to the said other company obtaining the new contract, except in cases where the company owning the lamp-posts prefers to remove them.

XXIX. All broken and "dead" wires, and all wires, poles and fixtures not actually in use—subject to rule XV.—must be removed from the streets, avenues and highways of the city. When an old pole is taken down it must be removed from the streets the same day. New poles must not be brought upon any street more than two days in advance of their erection. Any pole that shall lie on any street more than two days shall be removed by the Bureau of Incumbrances of the Department of Public Works, at the expense of the party owning it.

XXX. From and after the first of January, 1889, no company shall do business of arc electric lighting in the city of New York without a certificate of the board, granted on the recommendation and after inspection by the expert of the board, to the effect that its lines comply with all the rules and regulations of the board, and that its plant is in proper condition for the doing of its business. The force of the certificate to continue until changes are made, of which the board must be notified and approve, or so long as the plant and conductors remain in the same condition as when inspected.

XXXI. Every lineman must wear a badge in a conspicuous place, giving his number and the name of the company by whom he is employed.

XXXII. All permits of the board for overhead wires and fixtures are granted only pending the providing of underground accommodations in the neighborhood of the street or avenue for which the permit is granted.

XXXIII. Any member or officer of the board, and every inspector employed by it, as well as every member of the police force of the city, shall be entitled to examine permits under which work of any kind is being done.

XXXIV. No permit shall be granted for the erection of any overhead structure nor for the renewing of any lines already existing in any street, avenue or highway in which underground accommodations for the service have been provided, or are being provided.

XXXV. Every line, pole, fixture, etc., must be kept in thorough order, repair, and conformity with these rules and specifications, upon penalty of forfeiture of all permits granted to the owner by this board. But the general permit under which these repairs are to be made does not cover the erection in any street, avenue or highway of any new poles or other similar fixtures, and has absolutely no reference whatever to lines which have been ordered underground by the board, and which the Mayor has been requested to remove. In the case of such lines, where notice has been given that underground accommodations have been provided, and the ninety days of notice required by law have elapsed, and the Mayor has been requested to remove the same, companies owning or operating said lines are not authorized to make any repairs or connections or to go upon the poles bearing such lines *for any purpose whatever*, except to remove the said lines of electrical conductors in conformity with the directions of the board. Any deviation from this rule requires a resolution passed at a regular meeting of the board, attested by the secretary.

XXXVI. Every company or person erecting poles, wires or fixtures must make and leave, at least once each week, at the office of the board, such records of the fixtures, etc., which they are erecting, and of all of the same that they have in use, as are required by the engineer and the electrical expert of the board, and in such form as shall be prescribed by them.

XXXVII. The companies or persons owning or controlling poles in any street or avenue, erected under permits of this board or the Board of Electrical Subways, shall allow the same to be used by other companies or persons operating conductors for similar electrical service when authorized so to do by the board, on tender of proper compensation, to be determined by agreement between the parties interested. In default of such an agreement the amount of such compensation shall be determined by the board. This rule imports a contract on the part of each company or person owning or controlling the poles on any street or avenue, not only with the board, but also with each company or person who shall under its terms be qualified to demand the privileges it confers, to permit this joint use of poles. And in accepting any permit the applicant thereby binds himself to this agreement.

A Layman's Experience with Electric Roads.*

BY A. G. CLARK.

My experience began with the construction of the Baltimore & Hampden road in 1884, probably the first practical application of electricity to a road doing regular business. The fundamental principles developed in its construction are essentially the same as of to-day, the advance being made in mechanical detail and construction. It is hardly worth while for me to recite the various methods that are being experimented with. The only one known to me which has answered every requirement as to economy, changes of weather, etc., is the "overhead system." I do not know where storage batteries have been operating an entire road; and to-day, if acknowledged a success, it can only be considered so when operated in large cities, on account of the large operating expense. As electricians tell me there has been but little advance over twenty years ago in the results produced by storage batteries, it is to be hoped we are approaching the time when some great discovery will be made which will make them applicable to all street cars—there is no doubt this will be the perfection of street railroading. Several examples of underground construction are now in operation, but I know of none that have stood a winter test, without it be a road in California, where the construction cost from thirty to forty thousand dollars per mile, and where the conditions of climate afford us no opportunity of forming an opinion. If to-day we are to judge of the practical operation by electricity of street cars, in all its phases, there is really nothing, in my opinion, but the overhead system. All the various plans for constructing plants of this character are essentially the the same—generating a current at a station, of about five hundred volts, which is transmitted to a wire or wires, varying in size and number as the voltage may be more or less. I do not go into a description of the construction as I imagine every member present has seen electric roads in operation—it is more my purpose to make statements and suggestions which may be of benefit to those contemplating the adoption of this power.

In the first place, do not try cheap and inadequate construction; there is no place where economy can be so misapplied, for electrical machinery, cheaply and poorly constructed, is a most constant source of annoyance and expense.

Second: Start out with the knowledge that you will duplicate every part of your machinery, both steam and electrical, as the most perfect of mechanism may fail, and nothing is more annoying to the traveling public than delay. In addition to this you are repaid in the economy of operation and the saving of your machinery, as the non-crowding of boilers saves coal, and the changing off of machinery gives it a rest which is most desirable, especially to the electrical part, giving it a chance to cool, and saving many a burn out.

Third: Cleanliness is essential to satisfactory operation. The motor drivers should be required to keep their motors free from oil and dirt, and everything that tends to this end should be provided for them. A pit should be conveniently located, so that frequent inspection can be made of the gearing. All electric roads should have extra cars, not only in case of accident, but that in rotation the motors may be inspected, and taken apart and cleaned of oil and any copper dust from the wearing of the brushes. With proper care and system, I have no hesitancy in saying electric roads can be run economically. Of the two methods of over-running and under-running trollies, I would decide in favor of the latter, because there is not the weight and strain on the wire, nor is the trolley constantly falling on top of the car; also, in case of sleet, the water has a tendency to form in icicles on the under side of the wire, which the trolley wheel will knock off, while on top it forms a continuous non-conducting surface of ice, which must be broken to obtain a contact. The leaning of electric railroad constructors seems to be all towards placing the motors under the car and making connection by cog wheels to the axles. In view of this I have some hesitancy in saying my preference, except in case of heavy grades, is to have motor in front of car, for the following reasons:

First, it gives a better opportunity for the man to keep them clean.

Second, being always in sight, any tendency towards electrical difficulty can be checked at once, thereby often saving an armature or commutator.

Third, my experience has been that the motor drivers become attached to their special motors, like a locomotive engineer to his engine, and take pride in keeping them in order.

Fourth, the motor is out of the way of all chance of getting wet or dirty, or magnetically attracting nails or iron material in the streets.

When there are any considerable grades, the more direct method I should consider of advantage. If very heavy grades are to be overcome, a special "tow car" would be of benefit, rather than have weighty and expensive equipment on each car to simply meet the requirements of certain grades.

Before beginning to build a power-house, great study should be given to the location of machinery in the building, for if this is done properly quite a saving can be made in expenses of operating.

I believe an observance of the points I have so crudely made, as they are regarded or not, will tend very decidedly to make or mar the success of electric roads.

* Abstract of paper read before the Ohio Street Railway Association, Cincinnati, Nov. 9.

The Thomson-Houston Road at Lynn, Mass.

The accompanying engravings, Figs. 1 and 2, show a profile of the road, and a car on the grade, of the Highland line of the Lynn & Boston Railway Company, which has just been equipped with the Thomson-Houston Electric Company's railway system. As will be seen from the drawings, the road is composed of heavy grades and curves, so that the problem of construction was no mean one. The steepest grade which the car ascends is 8 per cent., which occurs on Rockaway street. There is one grade of 12 per cent., which, owing to the fact that the road is used as a belt line at present, the car is not called upon to ascend, though it has been done repeatedly to show it to be perfectly feasible.

Any one who has seen the overhead wires cannot fail to be impressed with the skillful and workmanlike manner in which the Thomson-Houston Company's electrical engineers have equipped a piece of road combining so many grades and sharp curves as this one. The car has been in operation since Nov. 19, and has been running to the entire satisfaction of the railway people. It worked perfectly all through the severe storm which recently visited Lynn, and clearly proved that snow and ice were no hindrance to the successful operation of the Thomson-Houston Company's apparatus.

Electric Light in Berlin.

The work done by the Edison Company in this town is so good, says *Industries*, that the public and the municipal authorities have perfect confidence in their ability to extend their central station work still further, and a concession has been given to this company for the establishment of two new stations, one in the centre of the town and the other in the southeast quarter, where most of the engineering works and other factories are situated. Both stations must be ready within two years, and each must be able to supply current for 6,000 glow lamps burning simultaneously. The station in the centre of the town will eventually be increased to a capacity of 24,000 lamps, and the other station will be increased to 12,000 lamps, the annual increase to be not less than 6,000 and 3,000 lamps respectively. All the cables required in connection with these stations must be in position by the end of 1892, and the supply of current within both districts will be compulsory, provided the customer is willing to take the light for at least one year. The network of cables to be laid down in connection with these stations is very complete, and practically comprises all the streets of the respective districts, some small and unimportant side streets alone excepted. In view of this extension to their business, the Edison Company propose to increase their share capital at present by £150,000, and later on by £300,000. The electric light installation in the Monopol Hotel of Berlin, which comprises 1,000 lamps, will shortly be in action. The work has been executed by the Berliner Maschinenbau-Actiengesellschaft, under the superintendence of Herr Beringer. The current is supplied by two 80 horse-power dynamos, each direct coupled to a twin engine. The dynamos are of the eight-pole disc type, and are compound wound. Steam is supplied by two Babcock & Wilcox boilers, having collectively a heating surface of 2,400 square feet.

The Lockwood Anti-Induction Arrangement.

To the Editor of The Electrical World:

SIR: I observe that you devote some space in your issue of Dec. 1 to a patent recently granted to me, describing a device which aims at diminishing the induction on telephone wires due to contiguous electric light circuits, and that you are also so good as to notice the same device editorially.

I desire to state, and at the outset, that this appliance is absolutely of no use whatsoever as a protector against induction set up by circuits carrying alternating currents. In that case the rate of change is very nearly if not quite as rapid as is the rate of reversal in the telephone current. Therefore the electro-magnetic coil is equally opaque to both currents. It is not, of course, necessary here to explain why; it is sufficient to state the fact.

It is editorially intimated that the proper means for thoroughly preventing induction from circuits carrying strong currents is the complete metallic circuit, etc. This is true, but there are conditions and differences as to the mode of application.

A metallic circuit is useless unless its two wires are close together, so as to be equidistant from the disturbing wire; or, of course, unless the disturbing wire be neutralized, by being itself one side of a metallic circuit, the other side of the same circuit being closely contiguous, so that the two wires of the same circuit induce equally but oppositely.

Now, the position of the telephone man is simply this: That he was on hand with his circuits and doing business; his current neither hurts nor offends anybody. Another man comes along with a current which spoils the business of the telephone man; but with a comparatively small number of lines.

The second man for many reasons must necessarily employ a metallic circuit, from pole to pole of his dynamo. The first man naturally thinks and says: "I was here first; I am supplying the public; my presence hurts no one's business; I have necessarily a great number of wires; but the electric light man comes in, he uses a machine with few sections in his commutator, when by using more he would have a steadier current; he has to have a metallic circuit in any event; he agrees with me that a properly constructed metallic circuit would materially improve the situation, and he has comparatively few wires. Where he is first I certainly will not go. His proximity to my wires ruins my business; I therefore have every reason in holding that it is his business and duty to run his wires properly, to employ a machine which develops a steady current, and to keep his wires a suitable distance from existing telephone circuits; and so the courts have more than once decided." No artificial appliance can take the place of a proper intervening distance between the two classes of wires.

T. D. LOCKWOOD.

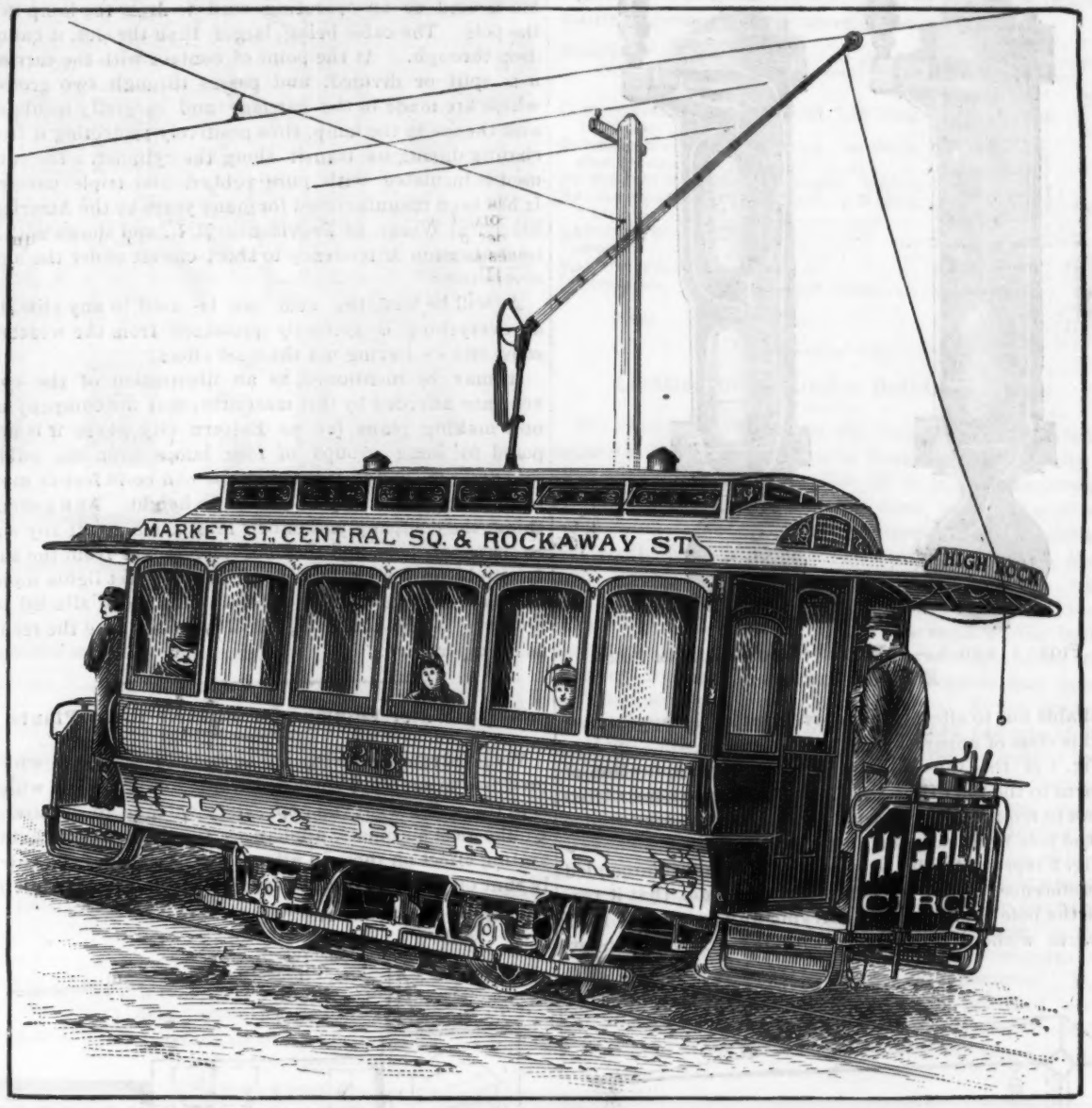


FIG. 1.—CAR ON THOMSON-HOUSTON ROAD, LYNN, MASS.

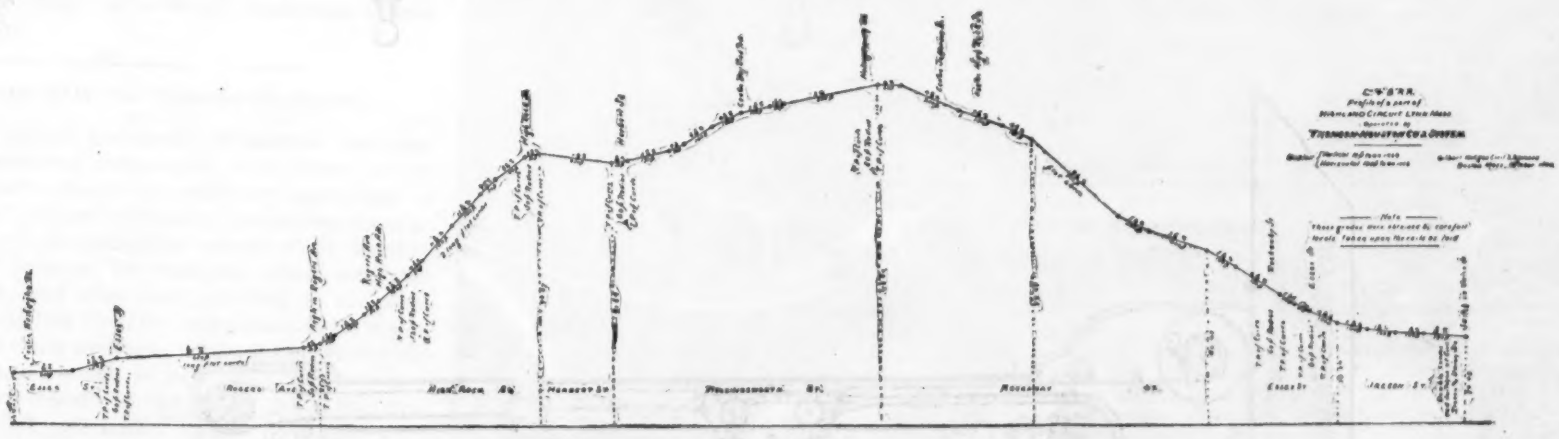


FIG. 2.—PROFILE OF ELECTRIC ROAD, LYNN, MASS.

Priority in Telpherage.

To the Editor of The Electrical World:

SIR: I notice in THE ELECTRICAL WORLD of Nov. 10 a letter from the United Electrical Engineering Company, Limited, dated London, Oct. 19, in which they claim to be the owners of the patents of Fleeming Jenkin and Ayrton & Perry in telpherage; that the telpherage system advertised by the Sprague Company has been called to their attention, and that in the event of infringement they will do all that is requisite to maintain these patents and stop infringers.

I would beg leave to say that an interference has long been in progress in the patent office between the Fleeming Jenkin patent and my applications, and as I am considerably ahead of Jenkin's dates of invention, and published a description of my invention some six years ago, and have practically worked the invention in this country, it remains to be seen whether "The United Electrical Engineering Company, Limited," will have any standing to sustain suits for infringement. The Ayrton & Perry patents are of but little moment, while that of Jenkin is very broad.

As for the Chandler patents no one knows better than I do the history of them.

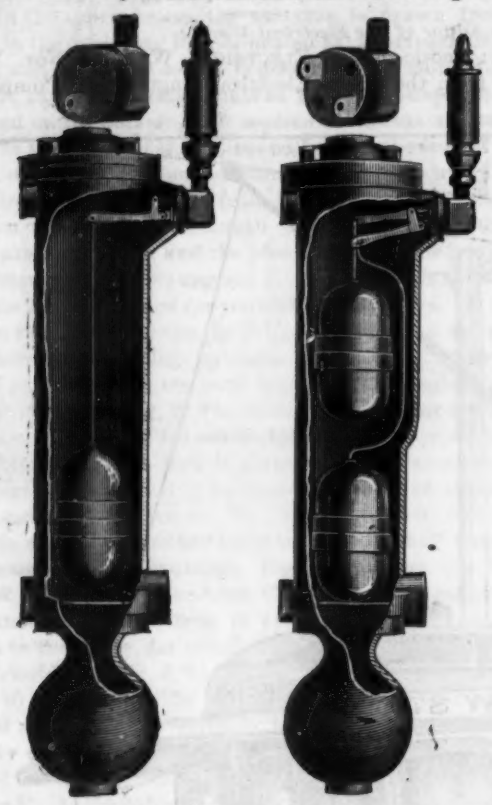
Foreigners will no doubt find it a difficult matter to have a word to say in this country in relation to electric rail roading.

R. M. HUNTER, M. E.

TROY, N. Y.

A New Mast Arm for Arc Lights.

A new mast arm for the suspension of arc lights over highways, and at the intersection of streets, etc., has recently been brought out by the Russell Electrical Manufacturing Company, of Providence, R. I. It embodies a number of new features, and the design of Mr. Russell has been not only to make an arm that would be generally



FIGS. 1 AND 2.—A WATER-COLUMN ALARM FOR ELECTRIC STATIONS.

available but to effect an improvement in the appearance of this class of apparatus.

Fig. 1 of the illustrations represents the application of an arm to the top of the pole. This arm is so constructed as not to require side or wind braces, and its appearance on the pole is actually as illustrated.

Fig. 2 represents the side arm, which is recommended in preference to the top arm, for the reason that it permits the pole being used for carrying any number of lines or wires without interference with the arm or lamp attendants, thus entirely obviating the necessity of erecting special poles for that purpose.

Fig. 3 shows the method of attaching the round braces, the position of the belt drum in connection with the crank, and the duplex cable passing over the hard wood roller. The main shaft of the arm is a hollow cylinder, with a slot cut longitudinally on the under side, thus allowing the pendant of the carriage to pass along the tube the entire length unobstructed.

Fig. 4 illustrates the main cylinder terminating in a head piece which contains a pulley and two small guide rolls. At the end next the pole is a box containing the drum *D* and roll *E*. Between the box and terminating head piece the carriage may run unobstructed.

Supposing the carriage with its suspending lamp to be near the pole, as illustrated in Fig. 4, to draw the lamp to its position over the street the lineman turns a small crank, which is preferably made permanent in connection with the drum *D*, which operates by means of the connecting cord *A*, passing through the tubular opening in the top of the carriage, to prevent interference with the wheels, and over the outer pulley and back to the carriage.

The member *B* is a flexible duplex electric cable conductor, which not only conducts the current to the lamp but is used as an operating cord to draw the lamp in to the pole. The cable being larger than the slot, it cannot drop through. At the point of contact with the carriage it is split or divided, and passes through two grooves which are made in the carriage and carefully insulated, and thence to the lamp, thus positively protecting it from chafing during its transit along the cylinder. The cable used is insulated with pure rubber, and triple covered. It has been manufactured for many years by the American Electrical Works, of Providence, R. I., and shows not the least abrasion or tendency to short circuit under the most severe tests.

As will be seen, the arm can be used in any climate, as everything is perfectly protected from the weather, snow and ice having not the least effect.

It may be mentioned, as an illustration of the convenience afforded by this mast arm, that the company are now making plans for an Eastern city where it is proposed to hang groups of four lamps over the public squares. In many cases the lamps will be 70 feet or more from the pole and about 50 feet in height. As a general thing, the company make their mast arms to fit any size or shape of pole, and they consider 21 feet from the surface to be proven the best elevation of street lights under normal conditions. The special case above alluded to, however, is very interesting, and we shall note the result as of importance.

Safety Water Columns for Electric Light Plants.

We illustrate herewith an automatic appliance which promises to supply a conceded want; an appliance which is to the water what the pop safety valve is to the steam. Unlike most automatic appliances, this one has an exhilarating effect on those in attendance, for it does not quietly shut off the water when it gets too high, or turn it in when it gets too low, but depends upon human efforts to do that, and whenever it gets as high or as low as it should, whistles for the fireman, at the same time informing the engineer, superintendent, and every one else in the vicinity of the approaching, though not imminent danger. If no one but the boiler attendant could hear the whistle, he would probably depend upon it; but as such is not the case, he takes extra care to keep the water right in order that the alarm may not be sounded.

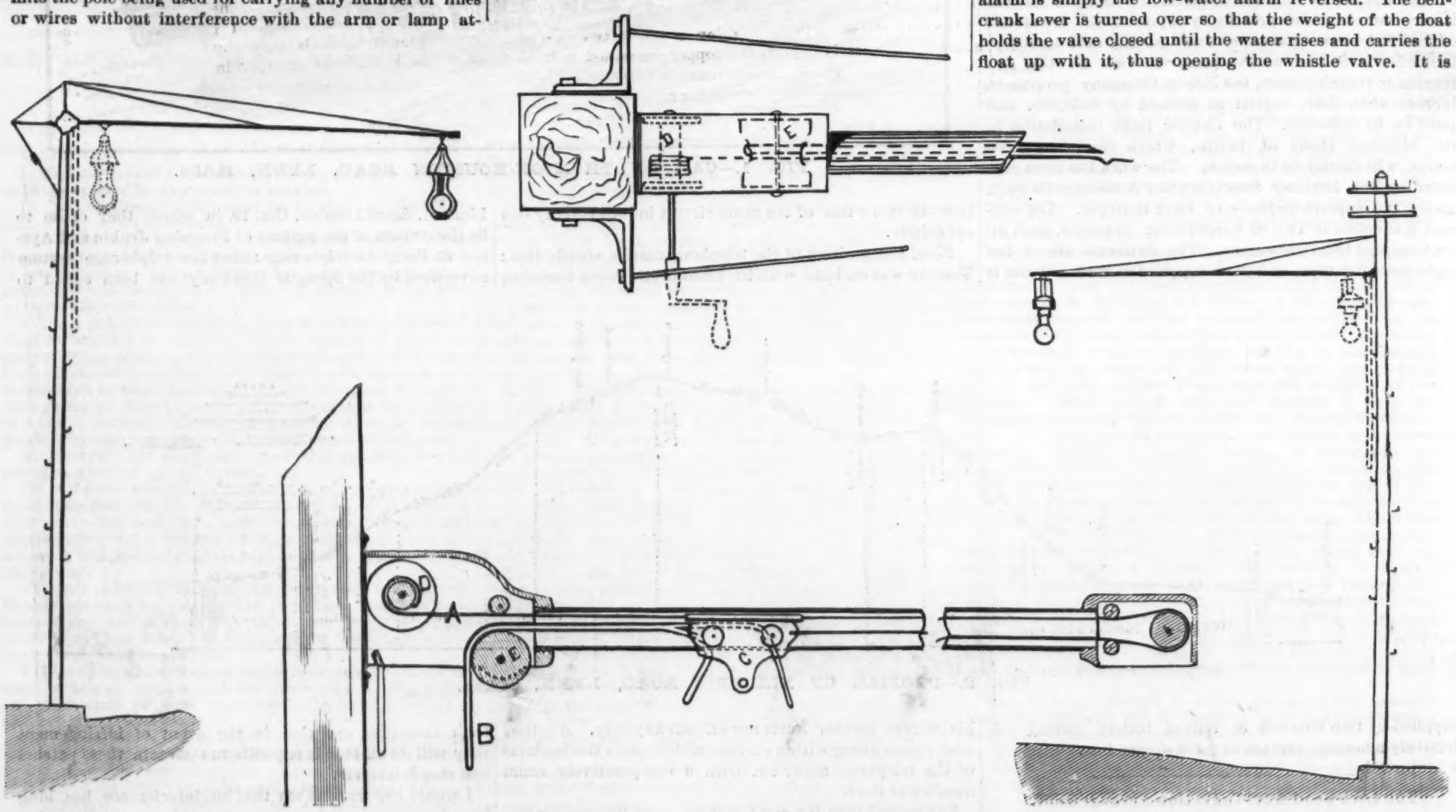
These safety water columns, which take the place of the common combination, are so simple in construction that they hardly require description. Fig. 1 shows the mechanism of the low water alarm. A bell crank lever connects the upright float rod with the whistle valve, and, when in use, with the water at the proper height, the solderless copper float attached to the lower end of the vertical rod is submerged, and, pressing upward, holds

FIG. 3.—WATER-COLUMN ALARM COMPLETE.

the valve closed; but when the water, from any cause whatever, such as leakage, stopping of injector, breaking of pumps, or carelessness, gets low enough to rob the float of its support, it sinks of its own gravity, thus opening the valve and blowing the whistle.

There is no difference in the principle of the high-water alarm, Fig. 2, the only change being in bending the rod so as to pass around the upper float, and the high-water alarm is simply the low-water alarm reversed. The bell-crank lever is turned over so that the weight of the float holds the valve closed until the water rises and carries the float up with it, thus opening the whistle valve. It is impossible for the water to pass either of these floats without automatically blowing the whistle.

The spherical projection at the bottom of these columns is a sediment chamber, the value of which cannot be overestimated. The sediment settles into it, and owing to the contracted neck connecting it with the column proper, it cannot pass back into the column when the blow-off valve is opened, as in ordinary water columns, and gauge cocks and glass are always clean. The cut, Fig. 3, shows the column complete. These safe-guards are manufactured by the Reliance Gauge Company, of Cleveland, O.



FIGS. 1, 2, 3 AND 4.--A NEW MAST ARM FOR ARC LIGHTS.

Electricity is Truth.

An incident happened recently at Manchester, Eng., which illustrates the moral effect of an electric shock. A certain Mr. Smith was discovered in a railway carriage senseless and ticketless. Being conveyed to the infirmary he recovered consciousness, but neither his ticket nor his power of speech. In fact, he declared in writing that he was both deaf and dumb. The doctors seem to have had strong doubts upon this point, and tried the application of electricity. The first shock Mr. Smith received from an induction coil not only enabled him to speak, but also to speak the truth. "My name is Smith," said he, "and you may put me down a rogue." "Great and many are the virtues of electricity," remarks the Manchester paper. "If certain politicians could only be compelled to make their speeches while in touch with a galvanic battery, we should evidently have more trustworthy history from them." The acumen of the doctors was applauded, and the value of electricity as a moral touchstone is now widely advocated.

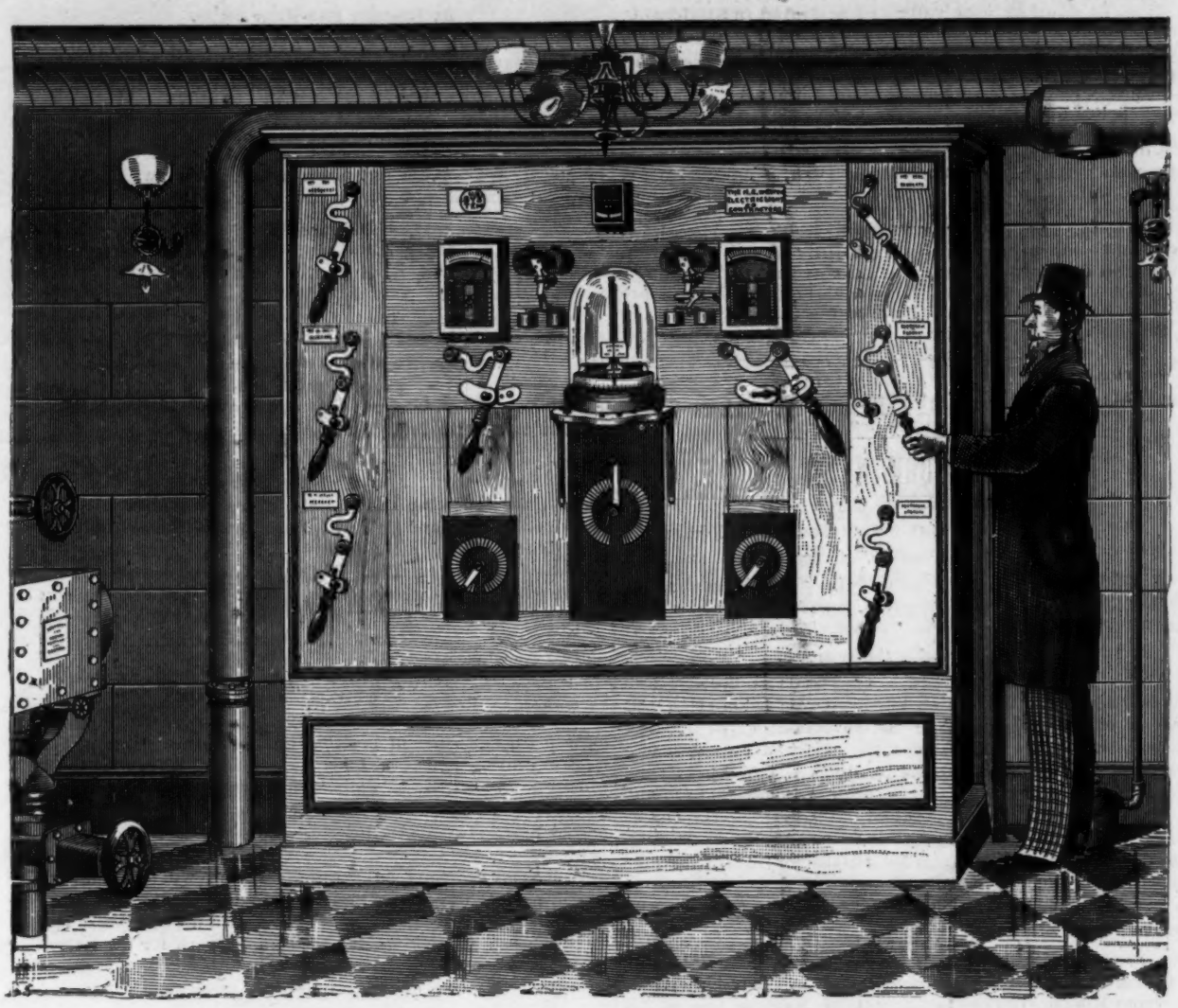


FIG. 1.—SWITCHBOARD, U. S. PLANT, EQUITABLE BUILDING, BOSTON.

The Electrolytic Purification of Alcohol.

M. Ponthière, of the University of Louvain has published some interesting information with regard to the methods employed in France for purifying the products of the distillation of various substances containing sugar or starch by means of the electrolytic process of M. Naudin. The alcohol of beetroot, for instance, when subjected to this treatment, and afterwards rectified in the usual manner, is entirely free from the unpleasant smell which characterizes the crude product; whilst the alcohol of the Jerusalem artichoke, which is, as a rule, completely useless, yields as good results if treated by the Naudin process as that distilled from maize.

The earliest attempts in this direction were made by M. Eisenmann, who, although he employed electricity, made no use of electrolysis. M. Eisenmann passed a current of ozonized air at 70 degrees C. through the liquid to be purified. To ozonize the air, it was sent through a glass tube placed between the terminals of an induction coil. This process certainly oxidized some of the deleterious constitutents of the liquid, but did not seem to act on the aldehydes which form the principal impurity of crude alcohol.

In the Naudin process the liquid is first hydrogenized by means of a Gladstone and Tribe zinc-copper element. At M. Boulet's works, at Bapaume-le-Rouen, wood or iron vats are used containing a number of zinc plates which are alternately flat and corrugated. The weight of zinc in a 150-hectolitre (3,300 gals.) vat is 6,200 kg. (6 tons); the number of plates is 105 and the active surface equals 1,800 square metres (19,800 square feet). Sulphate of copper is dissolved in the alcohol to be treated, and the reduced copper is deposited on the zinc plates. Five solutions containing .5 per cent. of copper sulphate are employed in succession. The total weight of copper deposited is 360 kg. (0.35 ton) in the case of the 150-hectolitre vat. The temperature at which the deposit is made is a matter of great importance; it ought to be from 30 degrees C. to 35 degrees C.; five degrees more or less injuriously affect the process. If the temperature is too low, the action ceases; if it is too high, the copper does not adhere firmly to the zinc plates. Each solution requires twenty-four hours to completely deposit the copper contained in it, so that the entire zinc-copper process requires five days. Owing to the formation of oxidized zinc-hydrate, 5 kg. of hydrochloric acid are added every week for every 150 hectolitres of alcohol treated.

The above process is generally sufficient to completely purify the crude alcohol, but owing to the presence of other impurities it is sometimes necessary to employ electrolysis before rectification. The voltameters in which this latter process takes place are glass cylinders 125 mm. in diameter and 60 mm. long, furnished with ebonite caps, through which pass the copper electrodes and the supply and overflow pipes. To treat 300 hectolitres in twenty-four hours M. Naudin employs twelve voltameters, two in series and six in parallel, using a total current of 36.65 ampères and an E. M. F. of 113.5 volts. The current is furnished by a four horse-power Siemens shunt-wound dynamo. To neutralize the small quantity of hydrochloric acid employed to acidulate the solution some zinc is placed in the vat supplying the still in which the spirit is rectified.

M. Naudin has furnished the following figures as to the cost of each of the above operations in producing one hectolitre (twenty-two gallons) of pure alcohol.

Treatment of 200 hectolitres of products of the first distillation by the zinc-copper process in twenty-four hours.

	Fr.
Commercial hydrochloric acid, 1.25 kilog., at 6 fr. the 100 kilog.	.075
Sulphate of copper, 1.25 kilog., at 56 fr. the 100 kilog.	.70
zinc consumed	
By the acid or sulphate of copper, 2 kilog.	2.10
By the liberation of hydrogen, 1.5 kilog., at 60 fr. the 100 kilog.	
Labor, 24 hours	7.
Power	2.
Maintenance and repairs	1.50
Depreciation, 15,000 fr. in ten years	4.50
Total	17.875

Lighting the Equitable Building, Boston.

We illustrate on this page the United States plant in the beautiful Equitable Building in Boston. The capacity of this installation is over 1,000 16 c. p. incandescendent lamps. The work has been done under the direct supervision of the chief engineer of the building, Mr. J. H. Kazar, and Col. Hewins, of the New England Weston Electric Light Company, who were the contractors for the electric plant. The dynamo-room, Fig. 2, is situated in the basement of the building, convenient to the boiler house and adjoining the room wherein are located the elevator engines and hoisting drums, steam pumps, injectors, etc. There are two dynamos of the United States standard pattern, of 400 lights capacity each, belted direct by Ireson's leather link belts to two Armington & Sims engines. These engines, the cylinders of which are 9½ × 12 inches, make 300 revolutions per minute, the dynamos running at 950 revolutions. Both dynamos are mounted upon adjusttable bases, placed on solid foundations of masonry faced with glazed bricks. From the terminals of the machines the cables are conveyed under the marble floor to the switch-board which is a splendid piece of workmanship and as effective as it is imposing in appearance. The switch-board, Fig. 1, is mounted in a case provided with doors at each side to admit the engineer or superintendent in charge to get in with ease behind the board proper for the purpose of making connections or whatever may become necessary. The entire apparatus occupies a space 6 feet wide by 7 feet high and 2 feet deep.

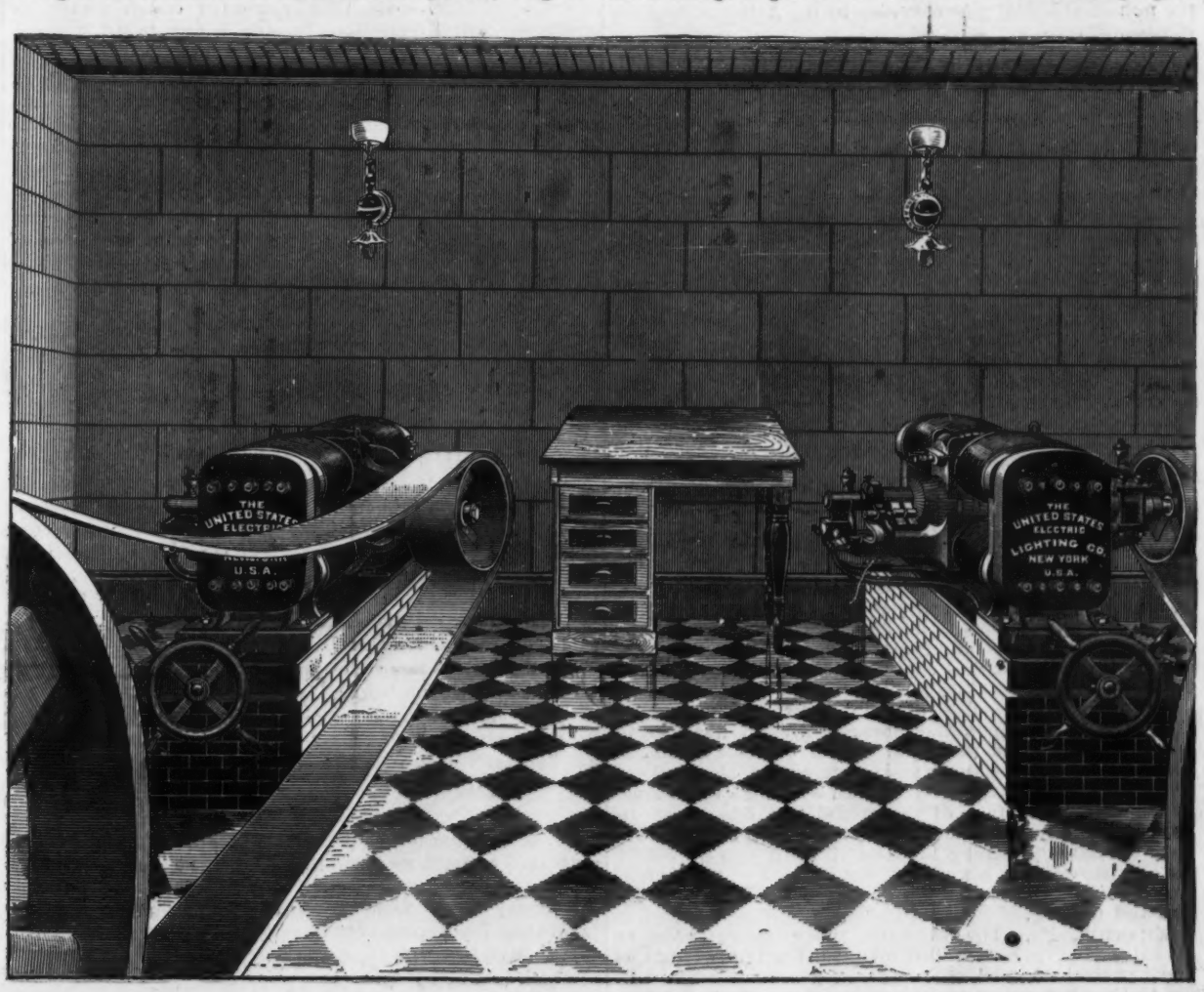


FIG. 2.—DYNAMO ROOM, EQUITABLE BUILDING PLANT, BOSTON.

Each dynamo has its terminals for both main and field wires in the switch-board, also for equalizing and controlling the E. M. F. A potential indicator is mounted on a shelf placed in the centre of the board, and each dynamo circuit has its own independent ammeter. These appliances are

shown with strict accuracy in one of the accompanying cuts. The building is divided for lighting purposes into six sections, each of which, as well as each dynamo, is controlled by a switch and automatic circuit breaker, and is consequently completely under the control of the attendant. The section of the building under control of each particular switch is indicated by an engraved plate. A ground detector is also attached to the switch-board. The dynamos, either both together in parallel or one alone, may be connected with any number or to all the lights in the building.

Running from the switch-board are 12 wires—six circuits—which enter a shaft near the centre of the building, up which the wires are taken to the point where they enter the elevator well, up which they are continued to the top of the building. On each floor branch wires are run to a box in which are located the individual safety fuses for that floor, and from which smaller wires are run directly to the lamps.

Three of the corridors are illuminated by "Mogul" lamps of 125 c. p. capacity each; the remaining corridors having 16 c. p. lamps on combination fixtures. In the main vestibule are suspended an elegant 30-light electrolier and two 4-light brackets in brass at the head of the marble stairway. There are also two lamps in each elevator. The handsome reading room of the Safe Deposit Company, which is one of the architectural sights of Boston, is lighted by ten 125 c. p. Mogul lamps fixed in the ceiling and thirty 16 c. p. lamps on handsome brackets over writing desks in alcoves and placed on massive brass Egyptian standards on the reading tables. The general effects produced are in the highest degree satisfactory. Corridors, offices, banks and elevators shine resplendently, while the *tout ensemble* of the reading room, which has always been a difficult place to light and ventilate, is quite unique.

In various parts of the building about thirty ventilating fans driven by C. & C. motors have been placed, which add much to the comfort of everybody who has business in the building.

Altogether this plant is a great success and merits praise for the system and the contractors who have installed it. As we have stated above, the New England Weston Electric Light Company are the contractors for the whole, but the especial features have been looked after or supplied by the following: The Okonite Company of New York supplied all the wire and cables, of which the following amounts have been consumed: 1500 feet No. 2 wire; 1200 feet No. 3; 20,000 feet 14 twin; 400 feet No. 0 cable. The Jarvis Engineering Company, Boston, supplied and erected the engines. Mr. C. L. Ireson, 97 High street, Boston, furnished the link belts. The steam piping was furnished and placed by Messrs. J. B. Perry & Co., Boston., the non-conducting pipe covering by the Asbestos Packing Company, Boston, while the handsome electroliers and brackets were supplied by the Archer Pancoast Manufacturing Company, of New York and Boston.

Notes on Some Sprague Electric Street Railways.

The month of November, reports the Sprague Company, has seen a vast increase among the electric railways in operation in this country, a great many new ones having been put into operation, and a large number of those which have been in operation some time upon the Sprague system having ordered additional equipments.

BOSTON, Mass.—Among those which are attracting very considerable attention among street railway men is that of the Brookline branch of the West End Railway. After a careful investigation of all the systems President Whitney awarded the contract for equipping this road to the Sprague Electric Railway and Motor Company. During the last month everything has been completed and in position for working. Last week the circuit was tried experimentally and found to be perfect. It is expected that the cars will be running and carrying passengers in a few days.

AKRON, O.—The electric railway installed by the Sprague Company at Akron, O., has been in operation now for about four weeks. The citizens of Akron are very much pleased with the electrical equipment installed in that city, and numerous petitions have been received by the management from residents in different sections of Akron, asking that the road be extended in their direction the coming spring.

DAVENPORT, Ia.—The electric railway installed at Davenport, Iowa, upon the Sprague system has been in operation for about the same length of time as that at Akron, and the president and directors of the road express themselves as very well pleased with their apparatus. It is a significant fact of the confidence which the directors of the road feel in their electrical apparatus that upon the date of opening the road all the horses owned by the company were advertised for sale. The number of motor cars on this road is eight, of the latest Sprague design and pattern.

SCRANTON, Pa.—The work on the electrical road at Scranton, Pa., to be installed upon the Sprague system, is being pushed forward as rapidly as possible, and it will not be long before all the cars will be in operation. The electrical apparatus of this road will include twenty motor cars, over twelve miles of track, and will supplant all the horses in use upon this road.

WILMINGTON, Del.—The Sprague electric railway in operation at Wilmington, Del., has been working very successfully since its installation, and the management of the road have written a letter to the Sprague Company expressing their entire satisfaction, and have given orders for an additional number of cars.

CLEVELAND, O.—The Sprague electric railway to be installed at Cleveland, O., is being pushed forward as rapidly as possible. The overhead system on Euclid avenue has now been completed, and President Everett, of the road, hopes to have all the cars in operation within a few weeks. The first portion of the equipment ordered by this street car company includes 16 motor cars of the latest design and pattern.

ST. JOSEPH, MO.—The ability of an electric railway to be successfully operated even under the most adverse conditions of weather was fully demonstrated in St. Joseph, Mo., during the great snow storm in that city of Nov. 9. The cars ran regularly without stop, and the management feel very enthusiastic over a system which can be kept running without difficulty at a time when all of the other electric systems of light, power, telephone and telegraph had to suspend work. They have given orders for an additional number of cars. The Wyatt Park Railway, of the same city and upon the same system, is now in course of erection and will soon be completed. The number of cars upon this road will be eight.

WILKESBARRE, Pa.—The Wilkesbarre & Suburban Railway has been running very successfully since its installation, and has been giving great satisfaction. The number of cars in operation on this road is four, and these are now to be increased through a new order to the Sprague Company.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Dec. 3, 1888.

Personals.

Mr. F. R. Chinnock, the well known Long Island agent of the Edison Company, has been appointed agent for the Charles Munson Belting Company.

Electricity before the Telegraph.

At the meeting of the New York Electrical Society, held on November 27, Dr. P. H. Vander Weyde lectured on the subject of "Electricity before the Invention of the Electric Telegraph." The lecturer divided the history of electricity into six periods, as follows: 800 B.C. to 1600 A.D., reaching from Thales of Miletus to Gilbert of Colchester; from 1600 to 1790—*i.e.*, from Gilbert to Galvani; from 1790 to 1819, Galvani to Oersted; from 1819 to 1833, Oersted to Faraday; 1833 to 1860, Faraday to Pacinotti; and from 1860 to the present. The lecturer showed how the epochs became shorter and shorter, illustrating in a striking degree the rapidity with which discoveries are now made.

The Usefulness of Accumulators.

Owing to an accident to the steam plant in the residence of J. Pierpont Morgan, Thirty-sixth street and Madison avenue, this city, some weeks ago, he was left without any means of illumination except candles, gas having been abolished some time previously, and as he expected to give a large dinner party the following evening, it was necessary to take prompt measures to remedy the defect. The Electrical Accumulator Company having a supply of accumulators for temporary lighting, and being appealed to, began the work of charging them at 4 o'clock in the afternoon, finishing at 12 o'clock noon, the next day. The accumulators (60—"15A" type) were then placed in crates, loaded on trucks and carted from their Newark factory to Mr. Morgan's house (10 miles), set up with necessary switches and appliances, and at six o'clock the light was turned on, thus supplying Mr. Morgan with electric light in ample time for his entertainment. He has expressed himself as greatly pleased with the success of the experiment, and has now arranged for a permanent installation of accumulators as an adjunct to the Edison direct lighting plant, thus supplying him with means of illumination during such periods of time as the direct service from any cause may not be available, and also on special occasions, such as entertainments, etc., when all or nearly all of the lamps in the house may be required, and which latter contingency could not otherwise be provided for except by the use of a larger dynamo.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Dec. 3, 1888.

Boston Electric Club.

The regular monthly meeting of this club will be held to-night. The Committee on Nomination of Officers and committees for the ensuing year will report, and several other matters of interest will be brought before the members. Action will also be taken on proposed amendments to Sections 3, 4, 5, 8 and 9 of Article 1 of the By-Laws.

Edison Isolated Plants.

Messrs. Paine & Francis, of Boston, New England agents of the Edison United Manufacturing Company, have made contracts for the following installations since November 15: 300 Edison incandescent lights at the envelope factory at Springfield, Mass.; and 225 lights at the straw goods manufactory of Messrs. Snow, Bassett & Company, Franklin, Mass.

Spencer Damper Regulators.

Mr. G. G. Stillman, the Boston agent for these regulators, reports sales recently made to the following-named electric light companies: Newburyport (Mass.) Electric Light Company; Malden (Mass.) Electric Light Company; Waltham (Mass.) Electric Light Company; Somerville (Mass.) Electric Light Company; Boston (Mass.) Electric Light Company, and the Palmer (Mass.) Electric Light Company.

Personals.

Mr. F. Elliott, brother to Mr. F. L. Elliott, of the Pacific Electrical Works, Oakland, Cal., has been in this city during the past week and favored this office with a visit.

The Sprague Electric Railway and Motor Company of New York was very largely represented at the "Hub" during the past week. Messrs. Frank J. Sprague, H. McL. Harding and H. F. Jenks were here.

Eddy Electric Motors.

Messrs. Dickerman, Adams & Co., Boston, Mass., New England agents of the Eddy Electric Manufacturing Company, Windsor, Conn., report recent sales by them of Eddy motors as follows: A 3 h. p. motor installed for R. E. Sparrell, printer, at 41 Arch street, which is working finely and giving the best of satisfaction, and a 2 h. p. installed for the India Drug Company, running a press for pressing herbs, at 24 India square, that is also doing good work.

An Enormous Feed-Water Heater.

The Wainwright Manufacturing Company, Boston, has in process of manufacture a special horizontal feed-water heater of 1,400 h. p. capacity. This huge heater was ordered by the Wm. A. Harris Steam Engine Company, Providence, R. I., and will be installed (when finished) in the steam plant of the Sagamore Mills, Fall River, Mass. The contract for the heater was secured by Mr. H. A. Buck, the new manager of the Wainwright Company's Boston and New York houses.

Premises Enlarged.

Messrs. F. E. Pettingell & Co., proprietors of the Eastern Electrical Supply House, Boston, have found it necessary to lease additional space, and have taken the large store adjoining their present establishment. The progress and prosperity of this young firm has been remarkable since the inauguration of their business last spring, and it is in a measure attributable to the large variety of the best grades of electrical goods and electric light supplies that they have kept in stock; they are constantly adding to these supplies to meet the demands of their numerous customers.

Sprague Motors.

The New England agency of the Sprague Motor Company reports the following recent installations in this city: G. H. Lloyd, grindstones and buffers, 1 h. p.; Geo. H. Binney, Sturtevant blower for ventilation, 2 h. p.; J. H. Dinner, sewing machines, ½ h. p.; M. Dean & Co., sewing machines, 1 h. p.; Noeling & Bloom, lathes, buffers, etc., 1 h. p.; Great London Tea Company, coffee mill, 1 h. p.; George Frost & Co., sewing machines, 5 h. p.; Excelsior Umbrella Manufacturing Company, sewing machines, drills and circular saws, 2 h. p.

Proposed New Station at Salem, Mass.

The Salem Electric Light Company has been for some time past agitating the question of erecting another and a much larger electric light station, as the building now in use is crowded to its utmost limit. Mr. H. M. Batchelder, treasurer of the company, stated to me recently: "I am so well pleased with the completeness and perfect arrangements of the various departments of the new station of the Cambridge Electric Light Company that just as soon as my company gets ready to build we will have in hand similar plans to those of the Cambridge station." Mr. H. C. Patterson, who made the plans and superintended the building of the Cambridge station, will attend to the same work for the Salem Company.

The Callender Company.

The Callender Insulating and Waterproofing Company, represented throughout the New England States by Mr. W. Forman Collins, have now moved into their new offices in the basement of the Hathaway building, 624 Atlantic avenue, where they will carry a large stock of their well-known "Trinidad" line wire, of which they have sold more than 1,000 miles in less than eight months, as well as their other specialties in wire and cable for inside and underground work. Samples of their underground system, which has been adopted for feeder purposes by so many of the Edison central stations, are to be seen in the office. Their increased facilities enable them to fill promptly and at short notice the largest orders.

The New Welding Works.

The Thomson Electric Welding Company are building new shops on Federal street, Lynn. The main building is 242 feet in length by 87 in width, with a monitor roof. It is built in two bays 30 feet wide and one 25 feet. Power for these shops will be furnished by a pair of Greene engines, 42 × 20, to run 100 revolutions, which will be built by the Providence Steam Engine Company, of Providence, R. I. The boilers are of steel and will be furnished by the Cunningham Iron Works, of Boston. The engine and boiler house is a separate building, 65 × 41. At one end of the main structure is the building for the offices. This building is 87 × 40, two stories, and will contain offices, experimental rooms, etc. The entire buildings are of brick, with granite trimmings, and are built in a most thorough manner E. P. Ball, civil engineer, of Palmer, furnished all of the plans, and had entire supervision of this large plant.

An Interesting Paper on the Alternating System.

Before the Boston Electric Club, on Wednesday evening, Nov. 27, Mr. H. L. Cutler, superintendent of the Newton (Mass.) Electric Light and Power Company, read a very interesting and instructive paper on the "Adaptability of the Alternating System." Mr. Cutler treated the subject in a creditable manner, in which he clearly evinced a thorough familiarity with the working and advantages of the alternating system as a factor in the electric lighting field. His points were mainly as follows: I believe that central-station lighting has in the future to look for its greatest field of usefulness and profit to the development and extension of the incandescent light. In order to bring that light into every house, street and store now lighted by gas or oil it is necessary to cover large areas, and to do this from one central station with profit two requirements are presented, namely: To perform it with profit currents of high tension or pressure must be used, and to do it with safety currents of low tension must be employed. These two seemingly antagonistic requirements are most beautifully worked out in the alternating and converter systems.

A primary current of high pressure and small quantity can be carried economically by small wires a distance of five miles from the station when properly strung upon poles or laid in conduits. It is a source of no danger save to employés of the electric company, who of course understand how to handle it. This high-pressure current is then transformed by means of converters into a current of low pressure and large quantity. The converters are connected to the primary wires at any point near where light is desired, and are extremely simple in construction and light in action.

The main feature of this system is the saving in the cost of copper wire necessary to cover large areas. The three-wire system requires twenty-seven times as much copper wire as the alternating system, using converters wound 18 to 1 and 52-volt lamp, and so far as the wiring alone is concerned this ratio holds good for distances of 10 feet or 10 miles. In regard to the cost

of running this system, it may be stated that a plant running about 100 arc lamps, with the light furnished at a minimum cost of one cent per hour, the minimum income of the department would be $10,000 per year.

In lighting houses by the converter system it would be desirable to use meters to decide what each house should pay. Such meters are to be had and have been pronounced reliable. Among other adaptations of the alternating system may be mentioned the compensating system, used for distances of 5,000 feet and under, and somewhat cheaper to install than the converter system. Alternating arc lamps and motors are upon the market, and the indications are that for every purpose to which electricity can be applied the alternating system must be recognized as possessing strong and constantly growing points of superiority, and that it is destined to play a most important part in the electrical progress of the future. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Dec. 3, 1888.

Bristol, Pa.

The Westinghouse Company is putting in an electric lighting plant for the town of Bristol, Bucks County. Over a hundred poles are being placed.

Reading, Pa.

A dispatch from Reading, Pa., says: "The new electric motor railway connecting this city with the village of St. Lawrence, three miles to the eastward, was put in operation to-day. The directors have decided that the fare shall be five cents each way."

The Sunday Storm.

The storm of last Sunday and Monday, Nov. 25 and 26, played sad havoc with the telegraph, telephone and electric light wires in this section, particularly along the Jersey coast, but the damage was soon repaired, and caused but little inconvenience. The Western Union Company were the heaviest sufferers.

Feed-Water Heaters and Purifiers.

Warren Webster & Co., proprietors of Webster's "Vacuum" feed-water heater and purifier, No. 491 North Third street, Philadelphia, Pa., have lately received orders from the following corporations and firms: The Edison Illuminating Company, Lancaster, Pa.; the Edison Electric Light Company, York, Pa.; the Gloucester City Electric Light Company, Gloucester, N. J.; Wissahickon Electric Light Company, Philadelphia.

Media, Pa.

A dispatch from Media, Pa., to the *Press* says: The electric light plant, wires and poles of the Haverford Electric Light Company, established two years ago for supplying light to Wayne and adjoining villages on the Pennsylvania Railroad, are in the hands of the sheriff of Delaware County. The principal creditor is the Philadelphia Electro Dynamic Company, whose judgment claim amounts to $20,211 86. George N. Taffan, of Philadelphia, also has a claim of $1,186.68 against the insolvent corporation.

Rutledge, Pa.

A proposition has been submitted to light Rutledge, a suburban town, with electricity. It is estimated that the best incandescent lights can be furnished to the residents for household use at a cost not exceeding the city cost of gas.

A Fire.

The Whitney Glass Works at Front and Kaighus avenue, Camden, seem to be having a run of unusually bad luck, as they were entirely destroyed by fire which started at half-past seven last Monday morning. The works were built about two years ago by the Crystal Glass Company, a co-operative organization, which soon failed, and they passed into the hands of the well-known Whitney Brothers, of Glassboro.

J. W. Queen & Co.

Messrs. James W. Queen & Co. will have one of the finest stores and manufactories in the country when their new building is completed. The structure now nearly finished will give them a space of 235 feet deep by 20 feet in width on the first floor, and with the exception of the space occupied by ventilating and light area in the centre of the building the four upper stories will be of the same dimensions. The electrical branch of the house has been of more recent and rapid growth than any of the others, and by reason of its addition the firm have been compelled to secure a large factory room, a store room and a sample room outside. Mr. Joseph J. Walton, who has charge of the electrical department, is a man of thorough knowledge, and has crossed the ocean twice in the interest of the house. The major portion of the instruments of precision used in the Signal Service are manufactured by Queen & Co., and their extensive and complete arrangements for the manufacture and testing of such work places them in the front rank of such establishments.

Boiler Compounds.

A recent issue of the *American Exporter* contains some wholesome advice in reference to Lord's boiler compound, they having investigated the subject of protecting steam users from the great trouble and danger caused by impurities in the feed-water. After speaking of various preparations, the article continues: "We find only one remedy which seems to meet with universal favor; this article is manufactured in Philadelphia, Pa., and is known as Lord's boiler compound. All our reports show that this article is unanimously endorsed by professional men throughout the Continent, among whom are practical chemists, authors of mechanical books, engineers in charge of works, professional inspectors and men having large capital invested in steam boilers. The chemists for the United States Mint in Philadelphia, Pa., testify under oath that Lord's compound will not injure the iron, while other reports, also of the highest authority, show that where boilers were eaten up in a year or two by acids or corrosive matter in waters, no sign of injury has been found since Lord's compound was first applied."

The Ball Engine Company

are doing an immense business in this section through the efforts of their representative, Mr. J. W. Parker, who is a specialist in the building and equipping of electric light plants. During the past three weeks the following orders have been taken by Mr. Parker: Two 12 × 12 inch Ball engines and one 60 inch × 16 foot 80 h. p. boiler and complete station outfit at Mahanoy City, Pa. This station burned down recently, entirely destroying everything but one 80 h. p. boiler. He expects to have them in operation in about four weeks. Mr. L. E. Snow, the Thomson-Houston agent, representing the Philadelphia Branch, sold them three new 35-light Thomson-Houston dynamos. The company were using the Ball engine and the Thomson-Houston dynamo before the fire. Also a contract to furnish the Danville, Pa., Gas Company a 13 × 12 inch Ball engine and 66 inch × 16 foot boiler, 100 h. p., and complete outfit to run a Fort Wayne Slattery alternating incandescent plant of 750-light capacity. He expects to have it complete by Jan. 1. The steam power plant at Pottstown, Pa., was awarded to him also last Tuesday. This was for a 150 h. p. Ball engine and two 66 inch × 16 foot 125 h. p. boilers and the building of the entire station. This plant will comprise the Thomson-Houston arc light, sold by Mr. Cloud, of the Philadelphia Agency, and the Edison incandescent, which will be installed by Walker & Kepler, of this city. Mr. Parker on Saturday contracted with the C. & C. motor people of New York to furnish an 80 horse Ball engine power plant in their new building on Greenwich street, New York. This will run an Edison 750-light machine for power purposes. An order from Mullin & Pierson for a 100 h. p. Ball engine lately given to Mr. Parker was last week replaced by an order for a 150 h. p. He has orders for a 150 h. p. for the Jackson & Sharpe Car Company, of Wilmington, Del., which will run the Edison incandescent and Brush arc lights.

Motor Cars in Philadelphia.

The National Conduit Company is about to make tests of an electric motor on the Traction Company's Columbia avenue line between Twenty-third and Thirty-third streets. President Kemble, of the Traction Company, says that there was no intention of substituting electric power for the cable, but that the conduit company was merely given permission to make a trial of its system. The fact of these proposed tests gave rise to a rumor that the Philadelphia Traction Company, which operates a number of miles of cable road in this city, was about to supersede the cable system with electricity. In denying this story, President Kemble took occasion to say:

"So far as the cable system and its abandonment for any other is concerned, that is all bosh. We are perfectly satisfied with it, but, of course, it is not perfect. The running of cars by electricity I regard with favor, and you may say in this connection that I believe the storage battery system the only one that will ever give satisfactory results.

"We regard the cable system as filling all necessary requirements as a motive power, with perhaps but a single exception—that is the one of an independent motive power for each car. This is overcome in the storage battery system of operation by electricity and becomes the great point of recommendation for that plan. Unfortunately the great cost incident to the running of street cars in this manner has operated to prevent its adoption up to the present time, but the time may come when this will be overcome, and then there is little in the way of its permanent establishment as one of the chief motive powers for street railway systems. We would hail with pleasure the success of any system of running street railways which would increase the conveniences of travel and lessen the costs of operation." E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Dec. 1, 1888.

Pipe and Boiler Coverings in Electric Plants.

Messrs. Shields & Brown, manufacturers of sectional pipe and boiler coverings, state that they are uncommonly busy for this season of the year. They are compelled to run the factory both night and day to keep up with orders for their goods. Although the season for them is somewhat backward, their present volume of business is much greater than that of any former period.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$149@$152	Iowa Union	$23@ $25
Central Union	46@ 47	Michigan	80@ 81
Chicago	330@ 335	Missouri and Kansas	69@ 70
Colorado	40@ 41	Rocky Mountain Bell	39@ 40
Cumberland	65@ 68	Wisconsin	115@ 117
Great Southern	30@ 35		

Sale of Telephone Plant.

A special from Superior, Wis., dated Nov. 23, reads as follows: The American Bell Telephone Company purchased yesterday the entire plant of the Superior Telephone Company for $35,000, and has commenced the work of placing the system in condition for operation. This settles the telephone war which has been going on for the last year. The Superior Telephone Company had been using instruments manufactured by the Cushman Telephone Company, of Chicago, but were obliged to remove them as the result of the lawsuit instituted by the Bell Company for infringement of its patent.

Adverse to the Postal Telegraph.

In the suit brought against the Postal Telegraph-Cable Company, by C. D. Lathrop, a Wabash avenue coffee broker, in Judge Baker's court, Monday last, a verdict for $6,698.30 was given the plaintiff. The suit was caused by the erroneous transmission of two dispatches to W. H. Crossman & Co., of New York, in June, 1887. He telegraphed an order for 1,000 bags of coffee, and then sent another telegram, using the words, "Buy in addition to thousand" another consignment, but the operator spelled the word "to" so that it appeared "two." Another was to "sell at 17," and the operator sent it "70," and while the New York brokers were wiring for an explanation, coffee went down several points, and broker Lathrop sustained losses on the two deals aggregating about $8,000.

"L" Roads.

The State street elevated road project came up in the city council at its meeting last Monday night. After a much prolonged and heated discussion the petition was placed on file. The aldermanic vote was a tie, standing 21 to 21. The Mayor gave the casting vote in favor of placing the measure on file. A previous motion to adopt the minority report favoring the ordinance was rejected by a vote of 23 to 20. This practically kills the State street "L" scheme for all time. The West Side projects will soon be brought up in the council. The Meigs scheme will probaly have the precedence of consideration, if its petition is sufficient. The Hannahs people are quite confident of success, however. The Onderdonk project as amended will not interfere with either. Its right of way is through a territory untouched by either the Hannahs or the Meigs scheme. Its chances of passages is thought at present to be good.

The Heisler System.

I have the following from the Heisler Company: "The Heisler Electric Light Company takes pleasure to be able to report to you a very large order for Sault Ste. Marie, Ont. The same is very gratifying indeed, as the Mayor and a select Committee of Council were sent out on a trip to investigate the various methods of street and commercial illumination. The result was so satisfactory to every one of the members that the Council unanimously voted in favor of adopting the Heisler incandescent in place of the arc, which it had been contemplated to install before their departure. The plant will be a large one, including 125 street lamps of from 30 to 60 candle-power and over 400 30-candle for commercial and private house use. The power will be supplied by the Sault Water Power Company, and will be in operation by the end of December. This is the first Heisler plant in Canada, but several very large ones will follow soon. One of our latest and most striking successes in favor of the Heisler system is a very large export order from Buenos Ayres, South America. The same company had purchased for a very large amount the Swan incandescent lamp plant for their city. The machinery is all packed and on board of vessel via England, from there to South America. We also received an order through Mr. Rusling, our Pennsylvania agent, for Kingston, Pa.; the plant will include street, commercial and private house lighting, having an extension of from 8 to 10 miles of circuit."

A New Installation.

I am in receipt of a copy of the Eau Claire (Wis.), *Sunday Leader* of Nov. 18, containing an article on a new electric light installation in that city. The installation was the first made by the National Electric Manufacturing Company of that city in the Pioneer furniture factory. The lights were started up on Saturday, the 17th. The article states that on "Saturday evening several interested parties visited the Pioneer furniture factory and found the same brilliantly illuminated with the new light.

"The dynamo is a modified Gramme type. The important changes in it are that the disposition of the armature and field magnets are such as to do away with any outside regulating devices whatever, such as resistance boxes, brush-shifters, etc., without which other machines have never been known to give satisfactory results. The machine is capable of generating 250 ampères at 100 volts, and so perfectly is the machine constructed from an electrical point of view, that without making any adjustments or changing any part or connection of the machine, six tenths of the whole number of lights in operation were thrown on and off with a deflection of only one volt difference in pressure. So slight is this change, that unless a person were looking directly at the voltmeter, he would not be able to see any change. The dynamo, instruments and all paraphernalia connected with the distribution of the lamps seem to have been carefully studied out and reflect great credit upon Mr. W. K. Freeman, the inventor, and his able colleague, Mr. C. Kammeyer."

Electricity in Mines.

A dispatch from San Francisco, Cal., dated Nov. 26, states, according to a dispatch from Virginia, Nev., that ever since the collapse of the Big Bonanza on the Comstock the problem has been to discover some process by which low grade ores may be handled profitably. The Sutro Tunnel lessened expenses greatly, but the heavy cost of fuel and the high price of labor have made it impossible to work most of the mines profitably, and the result has been a drain of over $40,000,000 in assessments from stockholders in the last twelve years. Only one mine on the Comstock is now paying dividends, yet with the cheap working of ores at least a score of the mines would become dividend payers. The solution of this problem is claimed to be found in electricity. A successful test was made yesterday of a sixty-stamp quartz mill, which was run by electric power generated in the Sutro Tunnel where it meets the Chollar shaft 1,700 feet below the surface. The great flow of water from the Chollar shaft is conducted in pipes, and falls on six large Pelton water-wheels with a pressure of 680 pounds to the square inch. These water wheels run six Brush dynamos in the tunnel, and the power thus generated is transmitted to the surface and delivered to Brush motors that make 850 revolutions per minute. Of this enormous power generated in the tunnel 60 per cent. reaches the surface and runs the stamp mills. It is claimed that this establishes the claim of electrical engineers that the great water power of the Truckee River, 16 miles from the Comstock mines, may be utilized in this way. If the loss of power be only 40 per cent., then at least 1,000 stamp mills could be run and many low-grade ores worked profitably. Thus the Comstock mines, which have been a constant drain on the pockets of poor stockholders, may at last pay back some of the millions sunk in assessments. E. L. P.

SOUTHERN NOTES.

HAGERSTOWN, Md., Nov. 27, 1888.

The Schuyler Electric Company have completed their plant at Hagerstown, Md., which consists of two 50-light machines and 100 arc lamps of 1,500 c. p. each, 65 of which are used for lighting the city and others for commercial purposes. The lights are diagonally suspended at intersection of streets, and give such satisfaction that an increase is proposed.

Previous to this the city was but meagerly lit with oil lamps. The eight lights furnished to the State Fair held here proved such a success that a number of applications for bids have been received from neighboring towns, and the outlook for further installations in this State, Virginia, and Southern Pennsylvania, is very promising. The arc line consists of two circuits, which cover a distance of 17 miles. This part of the installation, as well as the erection of building, placing of engines, boilers and electrical apparatus, was under the personal supervision of Mr. Bruce Smith, of the Schuyler Company, who spared no pains or expense in making the plant complete in every respect.

In addition to this there are two 650-light Westinghouse alternate current machines for commercial and domestic purposes in-

stalled by the Marr Construction Company, of Pittsburgh, Pa., under the supervision of Messrs. L. L. Kingsbury and C. F. Parmly, their usual high standard of work being kept up.

The incandescent portion of the plant started on Nov. 20 with over 500 lights, which have proved so satisfactory that more orders are being taken and filled as rapidly as possible. The electrical apparatus is so arranged on the switch-board that lights can be changed from one machine to the other, or from any feeder to either machine without affecting the lights. The circuits cover the entire town, the furthest light being about two miles from the station.

The Taylor Manufacturing Company, of Chambersburg, Pa., furnished the steam plant, which consists of two 125 h. p. automatic high-speed engines and two 150 h. p. steel return tubular boilers, the quality of their work being the best possible recommendation. Ample room is provided for increasing the building, which is 100 × 40, a substantial brick structure. Coal is obtained direct from the mines and delivered to boilers on a side track. The city water-works furnish the water.

DALLAS, Tex., Nov. 23, 1888.

A Proposed Electrical Society.

Steps are being taken towards to the formation of an electrical society in this city. There is abundant material for such an organization, and it is hoped that the idea will be carried out.

The Price of Gas.

As a result of the vigorous opposition on the part of the electric light company, the price of gas has been reduced in this city to $1.90 per thousand, a fact which the public are not slow to take advantage of.

A New Agency.

Mr. Jno. E. Land, the well-known real estate agent, has accepted the agencies of the Western Electric Company and the Mather Company, and is canvassing the field. Mr. Land is well known throughout the State and meets with a hearty welcome.

Fort Worth.

Forth Worth bids fair to have an electrical railway in the near future. A party of Boston capitalists recently purchased a large tract of land in the suburbs and the street railway property of the Rosedale Company. It is the intention to equip the road with motors.

Thomson-Houston Lights.

The Electric Light, Power and Manufacturing Company are enjoying prosperity. They are putting in a large number of lights, and so heavy has been the demand that they have ordered another 50-light Thomson-Houston outfit, which will be in position in a few days. The work on the 3-wire system will be pushed to completion, which will make the plant the most perfect in the state.

The Demand for Arc Lights.

The Common Council at its last meeting ordered an additional 45 arc lights placed at various points, making a total of 100 lights contracted for. They also at the same time ordered the different railroad companies to place and maintain lights at their various crossings in the city. This will be done at once, and with the city's lights will remove some of the gloom formerly so prevalent in Dallas.

A Bad Accident.

Mr. K. M. Sutton, the well-known electrician of this city, met with a very painful accident a few evenings since, which for a time threatened to be serious in its consequences. Mr. Sutton had, in the discharge of his duties, occasion to pass out of the stock rooms to the dynamo room of the Electric Light, Power and Manufacturing Company, and, failing to notice that the platform had been removed, he was precipitated a distance of several feet, and in falling his head came in contact with a solid brick foundation, cutting a severe gash and rendering him unconscious. As soon as he was discovered restoratives was applied, and upon his recovery he was removed to his residence, where medical skill was summoned. He is somewhat better now, but does not care to repeat his experience.

The Queen City Company.

The Queen City Electric Light and Power Company is very busy placing the lights already spoken of. In addition to this they have a large force at work connecting up their incandescents. Their first machine (1,000 lights) is already carrying its full number. A second one will be running in a few days. They have the contract for lighting the Grand Windsor Hotel (500 lights), so it bids fair to see another thousand required before the dynamos are in position. The plant was started Oct. 1, and under the admirable management of Mr. Owen J. Cook it is gaining in popularity. They have spared no expense, and the result is being seen.

Edison Plants.

Mr. W. T. M. Mottram, the popular agent of the Edison Companies, is an indefatigable worker. In addition to his labors in superintending the construction of the plants at Weatherford, Laredo and Gatesville, he found time a few days since to sell a 300-light plant to the Dallas Cotton and Woollen Mills. Competition was exceedingly sharp, but Mr. Mottram carried off the prize.

A Motor Lawsuit.

The *Times* Publishing Company of this city has entered suit against the Electric Light, Power and Manufacturing Company for damages due them, both actual and exemplary, through failure of the defendants to comply with the terms of a contract made between them, whereby the defendants were to furnish power to run their 4 h. p. Baxter motor. The failure to do so as agreed upon necessitated the plaintiff's purchasing an engine and going to other heavy expenses. The result will be looked forward to with interest.

Clower & Harris.

Clower & Harris report business in their various lines as being very brisk. The motor business is looking up, and they report the sale of a 4 h. p. arc motor and a ¼ h. p. arc motor, both of the well known Baxter make. The former will be used to run the elevator at the Grand Windsor Hotel, and the latter a printing press for Duncan & Higgins.

They have just completed the installation of the electrical apparatus in the beautiful home of the Dallas Club. In addition to wiring the building for 200 lights, they furnished one of Partrick & Carter's well-known annunciators, complete with return call and fire attachments, the case being made especially to match the woodwork. Mr. J. M. Oram, the well-known electrician, inspected the work in the interests of the club and pronounced it the most complete and satisfactory installation in the Southwest, and that the manner in which the contract was carried out reflected great credit on the firm. They have also completed the work at the residence of Mr. B. N. Boren, who placed a contract with this firm for an entire outfit, including combination fixtures, gas lighting apparatus, bells, speaking tubes, etc., and the result is seen. Messrs. Bergmann & Co. furnished the elegant fixtures, some of which were made after special designs. The gas lighting burners, etc., were from Partrick & Carter and A. L. Bogart, which explains itself. Mr. Boren is exceedingly pleased with the manner in which the contract was fulfilled, and does not hesitate to say so.

ENGLISH NOTES.

LONDON, Nov. 7, 1888.

Electric Haulage in Mines.

The facilities offered by the electric transmission of energy are at last attracting general attention among mining engineers. The colliery at Normanton, to which reference has so frequently been made, is now about to be equipped with hauling plant on the most extensive scale. The greater part of the material is already upon the spot, and work would have been begun already but for the interference occasioned by the recent strike, now happily at an end. In the presidential address just delivered by Mr. Rhodes to the Institute of Mining Engineers, great stress is laid upon the superior economy and efficiency of electric traction for mining purposes, and a confident belief is expressed in its development. On the other hand, at a meeting of a similar institution in South Wales in the same week, a resolution was passed embodying the opinion that no kind of locomotive would ever be suitable for underground work, apparently on the ground that it might run off the rails and block the line. This would seem to be an argument for laying rails in a proper manner rather than for the retention of the present crude and expensive methods of working. A great deal of educational work is, however, required before the old established methods are superseded. The calibre of the average mining engineer may be estimated from the questions which were put at the meeting just referred to to an electrician who was present: "In your experience as a practical man, do you find that a large or a small cable wastes most power?" "Is it a fact that an engine running on a level uses less power than when running on a grade?" etc.

The Metropolitan Electric Supply Company and the Westinghouse Company.

I understand that the Metropolitan Electric Supply Company have come to an arrangement with the Westinghouse Company for the introduction of their system into London. The advent of the Westinghouse Company in this country will be undoubtedly a matter of the first importance, and very lively competition will be certain to take place between the Metropolitan Electric Supply Company and the London Electric Supply Corporation, whose gigantic operations at Deptford I have quite recently described.

Electric Lighting Activity.

The district of Chelsea promises to be the battle-ground upon which several conflicts in the electric lighting act will be fought out by the rival electric supply companies, no less than three being already in the field. The Chelsea Electricity Supply Company have a good legal *locus standi*, having had their provisional order confirmed in the last session of Parliament. On the other hand, if possession be nine points of the law, the Cadogan Company have decidedly the best of it, for they have been at work for some little time and their small central station is in full swing. Lastly, the ubiquitous London Electric Supply Corporation have announced their intention of running overhead wires. The question immediately arises, what is to be the outcome of all this? It can hardly be the intention of the authorities to allow innumerable wires to be run indiscriminately in every direction, and to produce a state of things in the metropolis similar to that from which you have suffered so much in New York. And yet the possession of a provisional order does not apparently confer a monopoly, nor can the local authorities interfere so long as the intruders keep to the house tops. Without a provisional order you cannot break up roads or trespass on private property, but beybnd this no advantage seems to be obtained by possessing one. However, before long these and similar legal obscurities will doubtless be cleared up in the courts of law. Meanwhile the Chelsea Electricity Supply Company have issued a cleverly written pamphlet to their "future customers," in which underground wires and secondary batteries are much belauded and overhead wires and transformers correspondingly denounced. "Desultory and indiscriminate competition" is greatly deprecated by the Chelsea Electricity Supply Company, who "trust that the residents of Chelsea will not encourage it." Threatened competition has nevertheless had the salutary effect of causing the company to reduce their prospective charges.

The Board of Trade and the Electric Light.

At a committee meeting of the Electrical Trades Section of the London Chamber of Commerce held on Monday last, it was decided to take into immediate consideration the regulations which the Board of Trade have issued for the guide of the Kensington Court Electric Light Company, which is working under their license. Up to the present I have not found it possible to obtain a copy of these rules, but I understand they are of a very stringent character, and forbid the employment of alternating currents in toto. I should perhaps explain that the Board of Trade has power to enforce special rules for each case in which a central lighting station is worked under license, the rules not necessarily being the same in every case.

Electricity and the Financial Press.

The daily financial papers have lately made themselves conspicuous by much undiscriminating abuse of electrical companies of all sorts and conditions. The latest effusion of this kind appeared in a recent number of the *Financial Times*, and it can only be explained on the ground of gross ignorance or wilfull distortion of the facts. Undoubted swindles and respectable enterprises are bracketed together, and almost every prominent name in electrical circles is held up to contempt. We are told that the Whitehall Electric Supply Company "is a trumpery concern," that the Edison-Swan "exists in a sort of a way," and that the Gülcher Company, which is at present undertaking the lighting of the whole of the town of Wellington, New Zealand, "has retired into obscurity." To complete all, the writer then proceeds to praise the methods and organization of a non-existent organization, viz., the London Supply Company. It is possible, however, that the London Electric Supply Corporation is meant, though even then the writer is wrong as to his facts. I am afraid facts are not his forte.

Experminental Lightning Conductors.

In an interesting letter to the *Electrician*, Dr. Oliver Lodge, whose recent lectures and experiments have proved such a fruitful source of controversy, proposes the erection of what may be termed "observational" lightning conductors, in order to obtain, if possible, accurate data with regard to the many idiosyncrasies of the lightning flash. Dr. Lodge says: "An experimental lightning conductor on a flagstaff near every meteorological observatory would also be a most desirable addition. It need not be associated with danger; a system of fuses or cut-outs, or an east and west steel bar, might be used to record the passage of a flash, and the rod need not be examined until after the cessation of violent disturbances. By having the conductor of different thicknesses at different parts, one could learn what size is really likely to be melted. One could also arrange so as to gain information about side flashes." The *Electrician* in an editorial note suggests that the numerous and widely scattered stations belonging to the submarine cable companies would afford excellent sites for observations of this nature. The suggestion is certainly worthy of consideration, especially as one of the chief contentions of the Doctor's opponents is that his deductions are merely drawn from small laboratory experiments, and that experiments on nature's scale would soon put a different complexion on things.

The Early Researches of Professor Henry.

The early researches of Professor Henry have recently attracted attention in several quarters in this country. It is an undoubted fact that the oscillatory character of the electrical discharge was first experimentally discovered by Professor Henry in 1842. The *Electrician* is now publishing a series of papers by Dr. J. A. Fleming, on electro-magnetic induction, in which the most striking experiments of Henry are being recapitulated, and many of these experiments have now, for the first time, received complete explanation. Dr. Fleming, by the application of modern theory, has succeeded in deducing some very striking results connecting the electro-magnetic, physiological and electrolytic effects of Leyden jar discharges.

LONDON, Nov. 14, 1888.

Ocean Temperatures in Relation to Submarine Cables.

The opening meeting of the Society of Telegraph Engineers for the winter session was held on Thursday evening last, when there was a large attendance of cable men to hear a paper by Mr. William Lant Carpenter on "Ocean Temperatures in Relation to Submarine Cables." Mr. Carpenter first described several different kinds of registering thermometers which are used for ascertaining the temperature of the sea bottom, and he exhibited a series of charts showing the results which had been obtained. Mr. Carpenter then made a brief reference to the "Challenger" expedition, which lasted three and a half years, traversed 70,000 miles and established 362 observing stations. He then summarized the work of the United States steamer "Tuscarora," sent out to ascertain the most practicable cable route between the United States and Japan. The bottom temperature across the North Atlantic, from Madeira, through the Azores and Bermuda to Halifax had been ascertained to be between 34.8 deg. F. to 38.7 deg. F. In the Northern Pacific the bottom was colder. In the equatorial Atlantic the bottom was equally cold. Mr. Carpenter compared these results with those obtained in land-locked seas, like the Mediterranean, the Red Sea and the Sulu Sea. In the Mediterranean no lower temperature than 54 deg. F. had ever been met with, while in the Atlantic, a short distance off, 36 deg. was registered. Mr. Carpenter pointed out the great influence of temperature on the conductors and insulation resistance of cables. He also explained the above facts by a constant vertical circulation of the waters of the great oceans, due to the differences in specific gravity caused by differences in temperatures, this vertical movement being accompanied by a movement of the upper layers towards the poles and of the lower layers towards the equator, such seas as the Mediterranean being cut off from these general movements by submarine ridges.

The Board of Trade Regulations.

The *Electrician* last week published a copy of the draft regulations, which have been drawn up by the Board of Trade in connection with the Kensington Court Central Lighting Station, and to which I made some reference in my last letter. The Kensington Court Station, I ought perhaps to mention, is run on Mr. R. E. Crompton's famous B. T. system. The regulations are of a very stringent character, but on the whole there is not much to find fault with. They are divided into two parts, regulations as to safety, regulations as to supply. The first clause under the former heading requires that "the electricity shall be delivered in some manner free from risk of causing fire on the premises in question," and goes on to imply that the responsibility of the company is to extend to the wires, fittings and lamps. This is a point which will certainly require attention. It has hitherto been usual for the consumer to wire and fit his premises as he pleases, and consequently to take the sole responsibility. The maximum E. M. F. for charging the storage batteries is to be 250 volts, and the maximum upon the consumers' lines is to be 115 volts; not more than 3 per cent. variation from this standard being allowed.

Reduction in the Price of Gas.

The immediate result of the announcements with reference to the Deptford scheme has been to cause the Gas Light & Coke Company, which is by far the largest concern of its kind in the United Kingdom, if not in the world, to reduce its charges from 2s. 9d. per thousand cubic feet to 2s. 6d. per thousand. This important metropolitan company has lowered its charges 17 per cent. within the year. The gas interest is, indeed, genuinely

alarmed, and one of its leading organs, the *Gas World*, says: "We certainly think that a general conference shou'd be held to consider what course is to be taken in order to insure that this creeping rival shall at least be subject to some control and limited to some district." With this slightly alarmist paragraph before them and the giant gas company with its enormous paid-up capital of over ten and one-fourth millions, reducing its charges by leaps and bounds, English electricians have some very big straws by which to see where the wind is blowing.

THE TELEGRAPH.

Looking for Business.—The Postal Telegraph Company has pushed its way into Erie, Pa., and will open an office to compete with the Western Union.

The American Fire Alarm Company, of Portland, Me., has been incorporated by C. F. Blackwell, of Revere, Mass., and others, with a capital stock of $30,000.

A Western Union Absorption.—The Western Union Telegraph Company absorbed the Atchison, Topeka & Santa Fe telegraph system at 12 o'clock on Dec. 1. An order was sent out at the same time reducing rates about 25 per cent. to all points on the Atchison system. There were about 2,000 miles of telegraph line involved in the purchase, and about 1,500 miles in Texas and the Indian Territory.

THE TELEPHONE.

Life Saving Service.—A telephone line 65 miles long has been strung on the Delaware coast, between Lewes and Chincoteague.

Wisconsin.—Advice from West Superior, Wis., states that the American Bell Telephone Company has purchased the entire plant of the Superior Telephone Company for $35,000, and has commenced the work of placing the system in condition for operations.

The Bell Telephone Company Wins.—At the instance of the Bell Telephone Company Judge Blodgett in the United States District Court, Chicago, on Dec. 1, refused to give the Inter-State Telephone Company further time in which to prepare their defense to charges of infringing on the rights and patents of the Bell Company, and issued a perpetual injunction restraining them from further action.

THE ELECTRIC LIGHT.

Harrison, N. J., is talking electric light.

Rock Hill, S. C.—An electric light plant is projected. Mr. J. London is Mayor.

Nashua, N. H.—The Nashua Electric Light Company is to run alternating circuits.

Newport, Ky.—The Newport Electric Light Company has been formed by J. B. Taylor and others with a capital stock of $50,000.

Cherryfield, Me.—The Cherryfield Electric Light Company has been incorporated by U. M. Nash and others, with a capital stock of $7,000.

Norridgewock, Me.—Mr. E. C. Russell is putting in Westinghouse incandescents, the current for which will be furnished from Skowhegan.

Martinez, Cal.—The West Hill Water and Electric Light Company has been incorporated by A. Noble and others with a capital stock of $40,000.

Greencastle, Ind.—The franchise, etc., of the Greencastle Electric Light Company has been purchased by parties from Springfield, O., for $25,000.

Kingston, N. Y.—The Kingston Electric Light, Heat and Power Company has been incorporated by G. J. Morse and others, with a capital stock of $50,000.

Lee, Mass.—The Lee Electric Light Company has been formed, with a capital stock of $10,000. Mr. W. Smith is president, Mr. D. Dunn is treasurer.

Nebraska.—The Nebraska Electrical Light and Motor Company, of Omaha, has been incorporated by D. B. Covell and others with a capital stock of $500,000.

The Holmes Company, of Gardiner, Me., has been awarded the contract for building the electric light plant which is to light Dover, Great Falls and Rochester, N. H.

Webster, Mass.—The Webster Electric Light Company has bought the Webster gas light plant, and will run the two plants. It is putting 250 lights in the Bates shoe factory.

New Orleans, La.—Mr. G. C. Hill, southern agent of the Sawyer-Man Company, is installing a plant of 150 incandescent lights in the Crescent City Brewing Company's brewery.

Willamette Falls, Ore.—The Willamette Falls Electric Company, of Portland, Ore., has been incorporated by D. P. Thompson and others, with a capital stock of $1,000,000.

Lampasas, Tex.—An electric light company is being formed at Lampasas to do an arc and incandescent business. Mr. H. E. Hedeman, the city engineer, can furnish information on the subject.

Lenox, Mass.—The Lenox Gas and Electric Light Company has been formed by W. R. Plunkett and others, with a capital stock of $30,000. Mr. Plunkett is the president and Mr. C. E. Merrill is the treasurer.

The Johnstone Subway System.—The Johnstone Underground Electric Light Company of this city has been incorporated by W. H. Johnstone, L. May, E. V. Loew, A. S. Dodd and others, with a capital stock of $25,000.

Camden, N. J.—The Camden Lighting and Heating Company has given the West Jersey Contruction Company the contract for fitting up the old mill property on Front street, Camden, for an enlarged electric light plant.

Bangor, Me.—The Bangor city council proposes to establish an electric light plant of its own at the city water-works, to be run by water-power, and has had Mr. F. H. Whipple in consultation. It is intended to start with 120 arcs at street intersections.

St. Johns, P. Q.—The committee appointed to canvass the residents for support of an electric light plant succeeded in getting enough subscriptions to go on, but it has been decided to await the action of the government as to lighting the public buildings.

Washington, D. C.—The United States Electric Light Company of Washington, D. C., has elected the following officers for the ensuing year: Samuel Norment, president; Seymour W. Tulloch, treasurer; William Dickson, secretary, and A. M. Renshaw, general manager.

Blue Ridge Springs, Va.—Philip F. Brown, lately mentioned as to replace his burned hotel with a new building to cost about $60,000, will put in electric light machinery. He wants to purchase engine and boiler with capacity for 150 incandescent lights.—*Mfrs. Gaz.*

Whitman, Mass.—At a town meeting, the sum of $3,000 was appropriated for the purpose of introducing an electric lighting system. The street lighting committee was authorized to make a contract with the Whitman Electric Light Company for a period of three years.

Newton, Mass.—The gas commissioners of Massachusetts have granted permission to the Newton & Watertown Gaslight Company to engage in electric lighting, prescribing a minimum capacity of 90 arc lights of 1,200 candle-power and 1,500 incandescent lights of 16 candle-power.

Brooklyn, N. Y.—The fight over the city lighting is being renewed. The old Citizens' Company gets 50 cents a night for its 1,200 c. p. lights, and the new Edison Company proposes to furnish similar lights for 30 cents. The old company has a very strong hold on the city lighting, having had, so far, no active competitor.

Kenosha, Wis.—Mr. J. H. Kimball, president of the Kenosha Gas, Electric and Fuel Company, writes that the company has bought out the old gas company and incorporated under the title above given. They have put in boiler capacity for a dynamo or two next summer, when it is believed a good patronage can be obtained for the light.

Harrisburg, Pa.—The contractor has a large force of men at work on the new Excelsior electric light station on Walnut street, east of the canal, and brown-stone and brick are being artistically put together at a rapid rate. A fair idea of the proportions of the building can be gained by the work already done, and it is being put up solidly and substantially.

Truckee, Cal.—The Truckee Electric Light and Power Co. was incorporated Oct. 1, with a capital stock of $10,000. T. B. Whitney is president; J. F. Moody, vice president; W. H. Kruger, treasurer, and C. F. McGlashan, superintendent and secretary. A No. 7 Brush dynamo, run by water power, is operating 42 arc lamps and giving perfect satisfaction. The entire stock is subscribed and not a single share can be purchased. Another arc dynamo and an incandescent dynamo are to be added to the plant.

APPLICATIONS OF POWER.

Augusta, Me.—It is reported an electric railroad will soon be built between Augusta and Hallowell, Me.

Fort Worth, Tex.—The Rosedale Street Railway Company's road has been bought, it is stated, by New England parties, who intend adopting electricity for a system of 19½ miles.

Lynn, Mass.—The Thomson-Houston Company is laying an electric railway to connect its buildings. It will start in the yard, running through the basement of Factory E to Factory A, and thence to Factory B.

Cincinnati, O.—The Sprague Company have just closed a large and important contract for an electric road for Cincinnati. It will be an overhead system. The road will run from the very heart of the city out to the Zoölogical Gardens.

Nevada Mines.—The managing director of a Nevada mine property has reported to London in favor of using electric power, and has already secured the water rights of the Walker River. The plant is to transmit 200 h. p. and to cost $50,000.

Wichita, Kan.—The report of the local Chinamen on the new Thomson-Houston road to Riverside is that it has "no hosee, no mulee, allee samee go likee hellee." Riverside property is reported by the local papers to have taken a big jump since the road went into operation.

Hot Springs, Ark.—The Hot Springs and Electrical Street Railroad Company have commenced grading for their street railroad, previously reported. It will extend to the Ouachita River, five miles, where a town is to be laid out. Electric motors will probably be used.

New Orleans, La.—An ordinance for electric street railway work has been passed by the Common Council of New Orleans, in favor of J. A. Walker, A. McLellan, J. Hernandez, E. J. Hart, H. Larquie, W. J. Behan and T. Pickles. It is provided that each car shall be self-contained, having its own power, and that no poles or wires shall be put up. Low voltage is also stipulated.

Newark, N. J.—The Essex Passenger Railway Company Newark, N. J., has applied to the common council for permission to erect the necessary plant for an electric railway over the Bloomfield line, between the stables and the city limits. They have already received the consent of the Bloomfield officials. The Daft system, now in use at Asbury Park, will be adopted. If successful, the lines will be extended to other routes.

Work in Texas.—Dorsey, Paine & Co., of Chattanooga, Tenn., state that they are negotiating with parties in Texas for an electric street railroad, and think it possible they may close up the contract in the next thirty days. They have several electric light plants to place, two of which they expect to have in working order in about sixty days. The electric work in general is increasing all over the South, and they are expecting a big winter trade.

Louisville, Ky.—The Central Passenger Railway Company are erecting a brick building, 60 by 100 feet, at Seventeenth and Walnut streets, for the plant to operate their road by the Thomson-Houston system. The road is about three or four miles long, and if results are satisfactory the company will adopt electricity as a motive power for their other lines. A 250 h. p. engine will be put in. The company have recently issued $750,000 of bonds for improvements.

Harrisburg, Pa.—The City Passenger and East Harrisburg Street Railway companies are asking for certain rights of way, and in both cases it is proposed to use electricity. The city will be encircled by street railway tracks within the next twelve months, and electricity seems likely to be doing the largest share of the work. There is said to be a possibility of the use of storage batteries on one of the roads. The present Sprague road continues to be a most gratifying success.

MISCELLANEOUS NOTES.

The Kansas Phonograph Company, of Topeka, Kan., has been organized by S. S. Ott and others, with a capital stock of $12,500.

The Chicago Cord Insulating Company has been incorporated by W. S. Driver and others with a capital stock of $200,000.

Whitman, Mass.—The Whitman Electric Company has been incorporated by D. A. Gurney and others with a capital stock of $20,000.

Electric Reduction Works.—Mr. Charles I. Talley, Boulder, is interested in electric reduction works to be established at Zongmont, Col.

Phonographs in the West.—The Illinois & Indiana Phonograph Company, Chicago, has been incorporated, with a capital stock of $2,000,000, to control the use of phonographs and graphophones and other speaking instruments. Incorporators, Green B. Raum, Franck Z. Maguire and Joseph Kirkland.

Fighting the Subway Board.—Judge Lawrence, sitting in Supreme Court Chambers, last week heard argument on the application of the United States Illuminating Company for an injunction to prevent the Subway Board from forcing them to put their wires underground. A large number of affidavits from experts was presented on both sides, as to the feasibility of putting their wires in the subways and of their operation there, but the Judge was inclined to limit his survey of the case to the legal points involved rather than the electrical. The United States Company charges jobbery and favoritism very broadly, and insists on the worthlessness of the subways put down by the Board of Electrical Control.

BUSINESS NOTICES.

McIntosh & Seymour, builders of compound engines for electric lighting, have increased their capacity by the addition to their shops of a building 40×80 feet, at Auburn, N. Y.

The Eureka Telephone.—The capital stock of the New York Eureka Telephone Company is $150,000. The headquarters are at 55 Liberty street. The officers are C. H. Sensuer, president; W. H. Phillips, treasurer; and F. Hemming, secretary.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Mr. Paul Pryibil, of 467 West 40th street, this city, manufacturer of pulleys, shafting hangers, and general wood working machinery, is building a new factory at 518 West 41st street, five stories, 75x75, with vacant lots on either side for convenience in handling goods. He is making a large exhibit at the American Institute Fair.

The Page Belting Company, of Concord, N. H., have established a store at No. 17 Federal street, Boston, under the management of Mr. J. P. Jewell, where they will keep a full line of their goods for the New England trade. Their business for October, 1888, was 30 per cent. more than for the same month last year. They will keep also a full line of the Gutta Percha and Rubber Manufacturing Company's goods, of New York City.

Steam-Pressure Regulator.—Nearly every steam boiler connected with electric light plants requires a reducing valve where it is desired to run a lower pressure for steam heating or for keeping a constant pressure on any of the machinery. The Mason Regulator Company, of Boston, manufacture a valve for that purpose which has proved very satisfactory. They are so very full of orders that they are obliged to run nights.

The Randolph Shafting Trust, Stewart building, this city, are manufacturers and dealers in self lubricating graphite journal bearings, shaftings, pulleys and hangers. Some of their graphite bearings put into the Havemeyers and Elder sugar refinery in September, 1887, are reported to have run continuously day and night ever since, seven days in the week, and to be practically as good as new. The avoidance of oil is a good point for electrical machinery.

Belt Shifting.—The fact that mechanical men are quick to investigate and pass judgment on a new idea, particularly when it is designed to supersede old ideas or methods, is illustrated in the belt-controlling device sold by the Schenck Belt-Holder and Shifter Company. A late improvement permits it to be placed at the driving-wheel of the engine, as it is independent of the shaft. One now in use shifts a 12-inch double belt running at the unusual speed of about a mile and a quarter a minute.

Messrs. Clay & Torbensen, of Camden, N. J., are prepared to manufacture all kinds of meritorious articles, both electrical and mechanical, and place same on the market. They are agents for the Roberts-Brevoort Electric Co., of New York, and report increasing sales of the batteries of this company. Messrs. Clay & Torbensen are also sole manufacturers and general sales agents of the Copeland oil vapor burners, boilers and engines, and the Depuy electric protector, to be used on an electric circuit where there is danger of excess of current.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

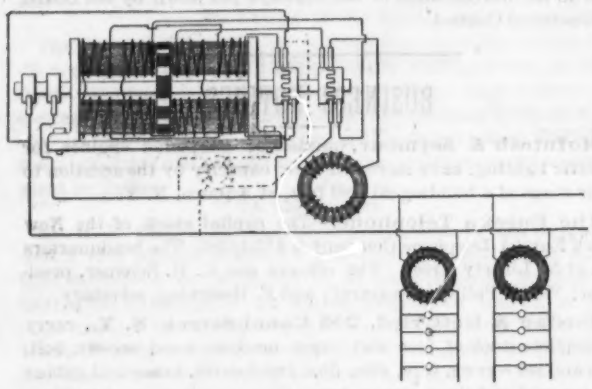
PATENTS ISSUED NOV. 27, 1888.

393,348. Apparatus for Removing Metallic Particles from Paper Pulp; Charles H. Atkins, Boston, Mass. Application filed July 16, 1887. This consists of pulp vats having sheet copper bottoms. In each bottom are a series of riffles containing mercury in their cavities, and between the riffles are placed rows of electro-magnets below the copper bottom. The magnetic fields attract magnetic particles of metal and the mercury causes the amalgamation of non-magnetic parts.

393,353. Porous Cup for Galvanic Batteries; H. J. Brewer, New York, N. Y. Application filed April 5, 1888. For the purpose of obtaining a highly porous cup the inventor combines with the clay, vegetable matter such as excelsior packing. After being molded the cup is subjected to heat which burns out the vegetable matter, leaving the cup porous. This reduces the internal resistance of the battery, and allows of the escape of the gases and fumes, which usually are passed out through passages left in the filling of the porous cup. The inventor also employs the same process for making porous carbon.

(1) 393,365. (2) 393,469. (3) 393,470. (1) Switch or Circuit Changer; (2) Dynamo-Electric Machine; (3) Distribution of Electricity by Secondary Batteries; Wm. W. Griscom, Haverford College, Pa., Assignor of No. 2 to the Electro-Dynamic Company, of Philadelphia, Pa. Applications filed June 30, 1888, June 30, 1888, and July 14, 1888, respectively. (1) The object of the invention is to afford a good contact. It consists of a fork-shaped terminal into which is forced a spring contact, also fork-shaped, so that contact is made in two places with spring pressure on each. (2) In this machine the armature is composed of two parallel cast-iron end rings which are maintained apart by strips of tinned iron. Upon these strips there is wound soft iron wire constituting the core of the armature. (3) The invention relates to the automatic charging of sub storage battery stations from a main station. This is accomplished by means of two co-operating magnets, one located in the charging circuit and one in the circuit connected to opposite terminals of the battery and indicating the variations in E. M. F. thereof. These two magnets control a local circuit containing an electro-magnet, which in turn operates an automatic switch. The latter is so arranged that in passing the battery in and out of the charging circuit an artificial resistance is connected in parallel with it, so that sparking is avoided.

393,373. Electric Motor; Fred J. Keller and James W. Carnes, Massillon, O. Application filed Jan. 24, 1888. The claim covers a device for wiping or cleaning the commutator.



393,448. REGULATION OF ALTERNATE CURRENT GENERATORS.

The device is so arranged that it may be pressed into contact with the face of the commutator at will, and recover its normal position when pressure is removed. See illustration.

393,389. Controller for Electric Circuits; Walter J. Paine, Boston, Mass. Application filed Oct. 21, 1887. The object of the invention is to control from a distant point two independent primary circuits, each containing a working apparatus and each working independently of the other. The invention is especially adapted for use in connection with electric motors employed to operate elevators, and by which the latter may be started, stopped and reversed from contacts placed either on the car or on any of the landings. See illustration.

393,391. Filament for Incandescent Lamps; G. S. Ram, Montclair, N. J., Assignor to Theodore Mace, same place. Application filed Jan. 30, 1888. This filament is prepared by first submitting the natural fibre to the action of hydrochloric acid, then washing, next submitting the fibre to a bath of strong sulphuric acid, then washing and incorporating metallic salts, and finally baking.

393,395. Galvanic Battery; H. L. Roosevelt, New York, N. Y. Alfred Roosevelt, executor of said H. L. Roosevelt, deceased. Application filed April 19, 1881. The claim is as follows: A cover for a battery cell composed of vitreous material provided with one or more openings for the passage of the electrodes and one or more electrodes extending through said openings and supported thereby, and provided with connectors outside the cover, whereby the deleterious effects of the fumes from the battery fluid upon the connectors are avoided.

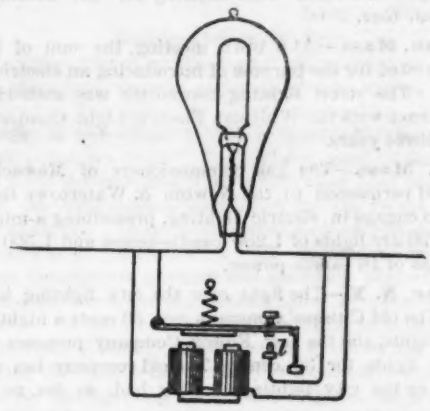
393,396. Natural Gas Protective Extinguisher; Charles E. Scribner, Chicago, Ill., Assignor to the Western Electric Company, of same place. Application filed June 1, 1888. This consists of a thermostat placed in a position to be heated by a gas jet, and so arranged that when the jet is extinguished the thermostat closes a circuit which operates an electro-magnetic device to turn the key and shut off the supply of gas.

393,405. Arc Light; D. B. Turner, Chicago, Ill. Application filed May 7, 1888. This is an arrangement by which the arc is maintained at the proper distance, by mechanism which moves both carbons.

393,422. Oiler for Commutators; T. E. Craig, Akron, Ohio. Application filed Aug. 20, 1888. This device consists of a small wheel in contact with the commutator which acts as a wiper to keep the commutator clean and prevent wear.

393,431. Train Signal; Albert C. Griggs, Wilmington, Del. Application filed May 31, 1887. This invention consists of an arrangement by which when a circuit is closed a valve is opened connected with a signal whistle on the engine, and is maintained open as long as the contact is closed. When the contact is broken again the valve closes automatically.

(1) 393,447. (2) 393,448. (1) Electric Arc Lamp; (2) Regulation of Alternate Current Generators; Gustave Pfannkuche, Cleveland, Ohio, Assignor of (2) to the Brush Electric Company of same place. (1) In this lamp there are two gears, one a slow movement gear for regulating the descent of the carbon holder and another for striking the arc. The slow movement gear is fixed in bearings so that it has no vertical motion by which any sudden descent or pumping downward of the carbon holder is avoided. The raising magnet is operated by a shunt circuit. 2) In this system a self-exciting



393,473. INCANDESCING ELECTRIC LAMP.

alternate current machine has a generating armature and field magnets which are provided with two sets of field coils and a commutator for straightening the secondary currents of a transformer. The commutated or direct current thus generated is sent through one set of the field coils, and a commutator placed in the main alternating circuit sends a direct current through the other set of field coils. See illustration.

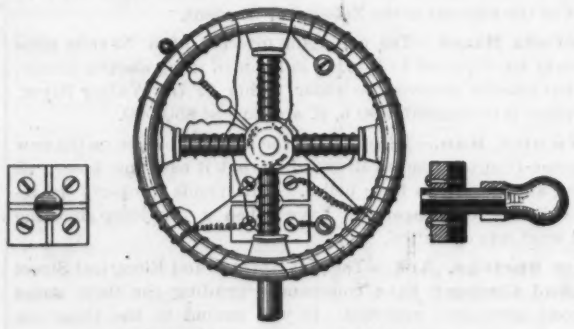
393,473. Incandescing Electric Lamp; Edward H. Johnston, New York, N. Y., Assignor to the Edison Electric Light Company, of same place. Application filed Jan. 9, 1886. This is an incandescent lamp designed especially for series systems in which high tension currents are used. The leading-in wires are twisted around each other and insulated from each other at a point outside of the vacuum. When the carbon breaks and the arc reaches the point where the wires are so placed, the wires fuse and thus short circuit the lamp and complete the circuit, thus forming an automatic cut-out. See illustration.

(1) 393,508. (2) 393,509. Multiple Switch-Boards; Milo G. Kellogg, Hyde Park, Ill. Applications filed Nov. 14, 1887, and Jan. 28, 1888, respectively. (1) This consists of a metallic circuit telephone exchange system containing novel devices for testing whether a line is in use, and in a system of connection whereby one loop switch-plug only is required for making connections between two wires, and in other details of switching, answering call, clearing out, etc. (2) This invention relates to telephone exchanges in which part of the subscribers' lines are single circuit and part metallic. The various lines of the exchange are switched together, and a system of testing at one board of the exchange determines whether a line is in use at another board.

393,525. Automatic Gas Lighting and Extinguishing Apparatus; N. H. Shaw, Somerville, Mass., Assignor to the American Automatic Lighting Co., of Portland, Maine. Application filed Jan. 23, 1888. This consists of a clockwork, which at stated intervals opens a gas cock and at the same time furnishes a spark to ignite the same.

393,529. Telephone Exchange; Wm. B. Van Size, Plainfield, N. J. Application filed Oct. 4, 1888. For description see page 300 this issue.

393,558. Electric Letter Box; Charles F. Harms, Hoboken, N. J. Application filed June 30, 1888. This invention consists in arranging two fixed electrodes in the lid of a letter box,



393,373. ELECTRIC MOTOR.

the ends of the electrodes projecting into a hollow space contained within the lid. The lifting of the latter causes mercury to cover the exposed contacts and thus close an electric circuit, which sounds an alarm indicating that mail matter has been deposited in the box.

(1) 393,572. (2) 393,573. (3) 393,574. (4) 393,575. (5) 393,576. (6) 393,577. (1) Apparatus for Propelling Cars; (2) Storage Battery; (3) Electric Light Regulator; (4) Secondary Battery; (5) and (6) Secondary Batteries; Leonard Paget, New York, N. Y., Assignor to the Macræon Storage Battery Company, of same place. Applications filed respectively July 21, 1888; May 8, 1888; May 28, 1888; Aug. 8, 1888; Aug. 8, 1888, and Aug. 30, 1888. (1) This invention consists of a car truck upon which is mounted an electric motor which is geared to loose pulleys mounted on the car axles. These pulleys when magnetized are attracted to similar fixed pulleys keyed to the car axles, and thus the power of the motor is transmitted to the car axles by the attraction and adhesion between the fixed and loose pulleys. (2) In this battery the negative electrode is so arranged that the active material is held in place by strips of metal which are entirely surrounded by the active material, so as not to expose any of the interior metallic surface. (3) This arc lamp consists of the usual carbons, which are shunted by means of a high resistance wire, so arranged that the heating effect of the current causes an elongation of the wire, which, acting on the pivoted carbons, causes their separation to form the arc. (4) This is a method of preparing the electrodes of storage batteries, which consists in fusing the active material, then immersing the frame or supports in the fused mass and finally allowing the whole to cool, so that the active material becomes firmly united to its support. (5) The active material is pressed or cast into intimate connection with corrugated sustaining strips. (6) In this battery the containing box is made of conducting material, to which one series of electrodes is intimately connected. The conducting lid of the box carries the other series of electrodes. In this way connection between cells can be made by placing one box on top of the other. See illustration.

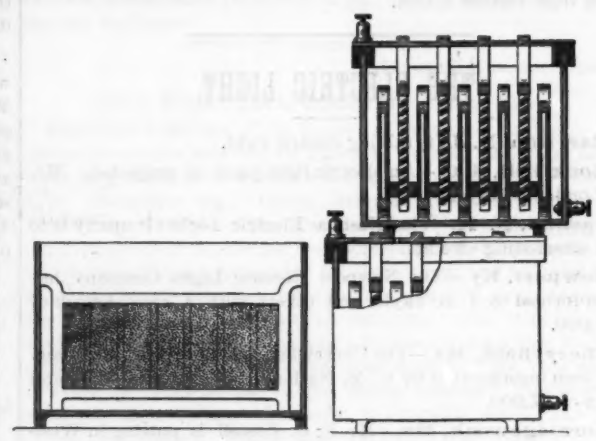
393,590. Regulator or Cut-Off for Generators; D. W. Smith, of St. Louis, Mo., Assignor of one-half to Joseph C. Addington, of same place. Application filed Nov. 26, 1887. This is a combination of devices by which the pressure in a steam or water pipe acting on a pressure valve at the same time operates the controlling mechanism of the electric power employed, so as to stop the circulation of water or steam.

393,612. Telephone System; C. W. Brown, Montreal, Canada, Assignor to the Bell Telephone Company of Canada, of same place. Application filed March 31, 1888. Patented in Canada, April 16, 1888. This is an improvement on the system of C. E. Scribner, Patent No. 356,427, known as the "factory telephone exchange." The purpose of the present invention is to do away with the "general" telephone of that system, and to give each department or station separate connection with the exchange, in addition to their present power of speaking to any other department.

393,622. Conduit for Electric Railways; Madison Dallas, New Orleans, La. Application filed July 20, 1888. This is a surface conduit consisting of a conductor which is embraced laterally by two protecting side pieces.

(1) 393,624. (2) 393,625. Coin-Operated Induction Coils; Charles Durieux, New Orleans, La., Assignor to the Southern Automatic Electric Shock Machine Company, of same place. Applications filed May 11 and June 8, 1888, respectively. These inventions relate to details of an automatic machine which a coin operates to set in operation for giving electric shocks.

393,636. Dynamo-Electric Machine and Electric Motor; W. P. Freeman, New York, N. Y. Application filed March 29, 1888. In this machine the field magnets consist of four poles alternating in polarity, which are generated by four



393,577. SECONDARY BATTERY.

coils connected together by expanded pole pieces. The armature consists of a similar number of poles and has expanded pole pieces so as to be capable of overlapping two adjacent field poles and short-circuiting their magnetism by affording a direct path for the lines of force. Only one-half of the four poles of the armature are wound with wire.

393,637. Electric Striking Attachment for Clocks; James H. Gerry, Brooklyn, N. Y., Assignor to the Self-Winding Clock Company, of same place. Application filed June 1, 1888. The invention consists in applying to a clock mechanism a striking device which will be operated at the proper intervals to give the necessary strokes for indicating the hour or fraction of an hour, if desired, the power being supplied by currents operating upon an electro-magnet.

393,639. Galvanic Battery; James L. Gethins, Boston, Mass. Application filed Feb. 7, 1887. This is a battery of the gravity type, consisting of a glass jar coated with asphalt, provided with a glazed flange forming a cover to the jar.

393,657. Electric Light Burglar Alarm Indicator; R. Packer and Isaac E. Cochran, Jr., Chester, Pa. Application filed July 6, 1887. The object of the invention is to automatically illuminate an incandescent lamp when a bell is sounded in a burglar alarm. The alarm mechanism and lamp are included in separate circuits operated independently of each other by separate batteries. The invention also embraces a series of lamps each having a specific character so as to denote different apartments.

(1) 393,710. (2) 393,711. (1) Electric Bell; (2) Electric Door Opener; Adam Lungen, New York, N. Y. Applications filed Nov. 21, 1887 and Jan. 16, 1888, respectively. For description see THE ELECTRICAL WORLD, Nov. 24, 1888. Article entitled "The Lungen Bell." (2) The invention consists of a number of details by which the device is reduced to very compact proportions, and is so arranged that a very small amount of battery power is required to operate the same, owing to the manner in which the force of the spring which tends to open the door is exerted upon the armature of the electro-magnet.

393,733. Incandescent Electric Lamp Socket; W. F. Wollin and E. H. Werline, of Williamsport, Assignors of two-thirds to Harry B. Cochran, of Lancaster, Pa. Application filed Sept. 24, 1887. This is a night lamp socket. It is so arranged that the key in one position allows the full amount of current to pass, and in another interposes a resistance so as to reduce the brilliancy of the lamp. This is all performed with one key.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.